
**CONCEPTUAL SITE MODEL AND SCREENING LEVELS
MACDERMID INCORPORATED
526 HUNTINGDON AVENUE
WATERBURY, CONNECTICUT**

RCRA RECORDS CENTER
FACILITY Mc Dermid
I.D. NO. CTD000164599
FILE LOC. R-13
OTHER RDMS # 10197



RDMS DocID 00100197

May 2002

Prepared for

**MacDermid Incorporated
245 Freight Street
Waterbury, CT 06702**

Prepared by

**LOUREIRO ENGINEERING ASSOCIATES, INC.
An Employee Owned Company
100 Northwest Drive
Plainville, Connecticut**

Comm. No. 91MW206.001



Loureiro Engineering Associates, Inc.

May 2, 2002

United States Environmental Protection Agency
New England Region
Office of Site Remediation and Restoration
1 Congress Street, Suite 1100
Boston, MA 02114-2023

Attn: Ms. Carolyn Casey

RE: RCRA Voluntary Corrective Action Program
Conceptual Site Model & Site Screening Levels
MacDermid, Inc., 526 Huntingdon Avenue, Waterbury, CT
CTD001164599

Dear Ms. Casey:

Enclosed for your review is the report entitled, "*Conceptual Site Model and Screening Levels*", dated May 2, 2002, prepared by Loureiro Engineering Associates, Inc. (LEA) on behalf of MacDermid Incorporated (MacDermid). LEA has been retained by MacDermid to assist with attainment of stabilization at MacDermid's 526 Huntingdon Avenue facility in Waterbury, Connecticut (Site).

MacDermid entered the voluntary corrective action program (VCAP) to expedite the stabilization process at the Site and has since completed an evaluation of Site conditions. HRP Associates, Inc. (HRP) was previously retained by MacDermid and completed the Site evaluation on behalf of MacDermid. HRP developed a "*RCRA Corrective Action Stabilization Report*" on March 16, 2001 and the document was revised on May 23, 2001 based on comments from the United States Environmental Protection Agency (EPA).

The attached report reflects a revised stabilization approach and includes a Work Plan to address specific comments included in your February 11, 2002 letter and to fill data gaps necessary for the completion of the Environmental Indicator Determinations for the facility. In addition, we would also like to take this opportunity to inform you that LEA has contracted to remove the 55-gallon drums located on the MacDermid-owned vacant parcel on the north side of Huntingdon Avenue. A Work Plan addressing this removal will be submitted under a separate cover in the near future.



United States Environmental Protection Agency
May 2, 2002
Page 2 of 2

Thank you in advance for your prompt attention to this matter. If you have any questions regarding this project, please do not hesitate to contact me directly at (860) 747-6181.

Sincerely,

LOUREIRO ENGINEERING ASSOCIATES, INC.

Brian A. Cutler, P.E., L.E.P.
Vice President

CC: Rich Nave, MacDermid, Inc.

Table of Contents

	Page
1. INTRODUCTION	1-1
1.1 Historical Regulatory Framework	1-1
1.2 Report Organization	1-2
2. SITE SETTING	2-1
3. SITE SPECIFIC CONCEPTUAL SITE MODEL	3-1
3.1 On-Site Receptors	3-1
3.1.1 Excavating Laborers	3-1
3.1.2 Groundskeepers	3-2
3.1.3 Indoor Workers	3-2
3.1.4 Environmental Samplers	3-2
3.1.5 Trespassers	3-3
3.2 Off-Site Receptors	3-3
3.2.1 Off-Site Utility Repair Workers	3-3
3.2.2 Off-Site Residents	3-3
3.2.3 Off-Site Recreators	3-4
3.3 Institutional Controls	3-4
3.4 Security	3-5
4. SCREENING LEVELS FOR THE QUALITATIVE RISK ASSESSMENT	4-1
4.1 Introduction	4-1
4.1.1 Soil	4-1
4.1.2 Indoor Air	4-2
4.1.3 Surface Water	4-2
4.1.4 Groundwater	4-3
4.1.5 Sediment	4-4
4.1.6 Trench Air	4-4



LIST OF FIGURES

FIGURE	TITLE
Figure 1	Location Map - USGS Topographic Map
Figure 2	Conceptual Site Model

LIST OF DRAWINGS

DRAWING	TITLE
Drawing 1	Site Plan and Exposure Areas

LIST OF APPENDICES

APPENDIX	TITLE
A	February 11, 2002 United States Environmental Protection Agency Correspondence
B	Voluntary Corrective Action Program Work Plan (May 2002)



1. INTRODUCTION

Loureiro Engineering Associates, Inc. (LEA) was retained by MacDermid Incorporated (MacDermid) to develop a facility-specific conceptual site model (CSM) and screening levels for MacDermid's property located at 526 Huntingdon Avenue in Waterbury, Connecticut (the Site). MacDermid operates as a generator and a treatment, storage, and disposal facility (TSDF) of hazardous waste and is subject to the Resource Conservation and Recovery Act (RCRA) Corrective Action Program.

Drawing 1 depicts the Site plan and those areas subject to the RCRA Corrective Action Program. Included in the program is the entire 526 Huntingdon Avenue property and a portion of the vacant parcel, owned by MacDermid and located on the northern side of Huntingdon Avenue.

The United States Environmental Protection Agency (EPA) has identified the Site as a high priority RCRA Corrective Action TSDF and has established a goal of achieving "stabilization" at each high priority RCRA TSDF in New England by the year 2003. Stabilization is defined by EPA as, "...the goal or philosophy of controlling or abating immediate threats to human health and the environment from releases or preventing or minimizing the spread of contaminants while long term corrective measure alternatives are being evaluated...". EPA considers a facility to be stabilized when it meets two environmental indicators (EI), (1) control of current human exposures and (2) control of migration of contaminated groundwater.

In order for MacDermid to achieve stabilization at the Site, MacDermid entered a voluntary corrective action program (VCAP) to expedite the stabilization process and has completed an evaluation of the Site. The following discussion provides a summary of the work completed with respect to the VCAP as well as a summary of the relevant correspondence between MacDermid and EPA.

1.1 Historical Regulatory Framework

HRP Associates, Inc. (HRP) developed a "RCRA Corrective Action Stabilization Report", dated March 16, 2001, for the Site. The report included the following information:

- Description of site operations, site information, and site setting
- Description of site areas of concern
- Summary of all known environmental data



- Summary of human exposure pathways and human receptors
- Preliminary determination of the horizontal extent of contaminated groundwater
- Summary of environmental data gaps
- Well receptor survey

EPA issued a response and comment summary, dated April 4, 2001, and, based on this correspondence, HRP revised and finalized the aforementioned report on May 23, 2001. On February 11, 2002, EPA issued a follow-up response and comment letter following review of the stabilization report. In sum, MacDermid has not completed stabilization and additional activities are necessary to achieve this goal. The February 11, 2002 EPA correspondence is provided as Appendix A.

1.2 Report Organization

The physical setting of the facility, which includes a discussion of site history, regional and site-specific geologic and hydrogeologic conditions, is presented in Section 2. Section 3 includes the Site-specific conceptual site model, which details the specific on-site and off-site receptors and potential institutional controls. Section 4 provides a discussion and the rationale for determining generic screening levels and receptor-specific screening levels for the qualitative risk assessment.

Supportive documentation including tables, correspondence, and a work plan to address gaps in the current dataset are included in the attached appendices.



2. SITE SETTING

The majority of the Site is located at 526 Huntingdon Avenue in Waterbury, Connecticut, encompasses approximately 11 acres, and is located in a mixed industrial, commercial and residential area. The remainder of the Site includes the vacant parcel located along the northern side of Huntingdon Avenue which encompasses approximately 35 acres (Figure 1). Of the total facility area (526 Huntingdon Avenue), approximately ninety-five percent is developed and/or paved, with incidental grass areas located along the southern and western sides of the Site. Three interconnected buildings encompass a total footprint of approximately 182,500 square feet and are referred to as the Gear Street Building, East Aurora Street Building, and the Huntingdon Avenue Building.

The Gear Street Building has been occupied by MacDermid since approximately 1978 and is used for manufacture of inks and electroless nickel plating solutions and chemicals for metal finishing, plating on plastics and printed circuit board industries. Raw chemical storage and less than 90-day storage of hazardous waste is also located in this building. During the period from 1922 to 1978, Waterbury Steel Ball Company owned and occupied this portion of the Site. The East Aurora Street Building was constructed in approximately 1985 and is predominantly used for finished product storage and shipping and receiving. This building joins the Gear Street and Huntingdon Avenue buildings. The Huntingdon Avenue building has been occupied by MacDermid since approximately 1950 and houses the following operations: dry mix department, pilot plant, main mixing area, copper etchant process area, wastewater treatment system, acid aboveground storage tank farm, bulk spent copper etchant storage, bulk etchant loading/unloading area, and the quality assurance/quality control (QA/QC) laboratory. Prior to 1950, this building was occupied by the Carroll Wire Company. Operational activities of the Waterbury Steel Ball Company and Carroll Wire Company are unknown at this time and require evaluation in order to develop a comprehensive understanding of potential health risks at the Site.

The Site is situated at approximately 300 feet above mean sea level (MSL) and slopes gently to the southeast toward the Naugatuck River. Steele Brook and the Naugatuck River are located 0.17 miles and 0.2 miles to the southwest and east, respectively, and are separated from the Site by industrial, commercial and residential properties. Steele Brook has been assigned a classification of "B" and the Naugatuck River a classification of "C/B" by the Connecticut Department of Environmental Protection (DEP). A designation of "B" indicates that water quality has been impacted by a combination of factors including combined sewer overflows, urban runoff, and inadequate industrial or municipal wastewater treatment. A classification of



"C/B" indicates that the surface water body has been impacted by point or nonpoint sources of pollution and currently does not meet criteria to support one or more designated uses of a class "B" water body. The water quality goal is achievement of a class "B" designation and use which includes recreational use, fish and wildlife habitats, agricultural and industrial supply and navigation.

Groundwater beneath the Site may not be suitable for direct human consumption due to waste discharges, spills or leaks of chemicals or other land use impacts and has been assigned a classification of "GB" by the DEP. The GB groundwater classification includes the Site and surrounding areas within 1.0 mile to the south, east and west. The southern portion of the MacDermid-owned parcel to the north is also classified GB. Groundwater beneath properties to the north and including the northern portion of the MacDermid-owned parcel is classified as "GA" by the DEP. Based on information provided in the May 23, 2001 "RCRA Corrective Action Stabilization Report", depth to groundwater beneath the Site is approximately 33 feet below grade.

On April 22, 2002, LEA conducted a facility visit and interviewed MacDermid employees to gain an understanding of land use and activities that are conducted at the Site and immediately surrounding areas. Included in the interview process were the following MacDermid personnel: Richard Nave, Corporate Manager of Regulatory Affairs; Jeffrey Scott, Distribution Center Manager; Mario Cellupica, Shipping Clerk; Melvin Gonzalez, Production Worker; Tom Johnston, Production Worker; and Sid Amasya, Logistics Manager. Currently, MacDermid is conducting consolidation activities at the Site and is relocating the majority of manufacturing processes to its Freight Street facility. The future planned use of the Site will include warehousing of raw materials and finished goods. The conversion of the Site to a warehouse use is expected to be complete by June 2002.



3. SITE SPECIFIC CONCEPTUAL SITE MODEL

This section provides a discussion of the potential exposure scenarios and contaminant migration pathways likely to be encountered at the MacDermid Huntingdon Avenue facility. The Conceptual Site Model (CSM) has been developed to describe the means by which activities at the Site may bring potential human receptors into contact with Site contaminants.

The majority of employees spend most or all of their time indoors within manufacturing or office areas. When outdoors, employees contact only paved areas of the facility. There is very limited opportunity for employees to come into contact with soils since the majority of the Site is paved. Contact with groundwater is also highly limited since water supplied to the Site originates from the City of Waterbury. Potential contact with groundwater would be limited to periodic collection by environmental samplers.

On-site receptors that could potentially be exposed to one or more environmental media at the Site include: Excavating Laborers during construction, Groundskeepers, Indoor Workers, Maintenance Workers, Environmental Samplers, Trespassers, and in few instances, Recreators. Manufacturing and office workers (i.e. Indoor Workers) are exposed only to indoor air, which may be potentially impacted by underlying soil and/or groundwater. Recreators could potentially be exposed to areas of grass or exposed soil.

Off-site receptors that could potentially be exposed to one or more impacted environmental media emanating from the Site include: Recreators, nearby Residents, and Utility Repair Workers.

3.1 On-Site Receptors

On-site receptors that could potentially be exposed to environmental media at the Huntingdon Avenue facility are discussed below. Figure 2, the Conceptual Site Model, depicts the different types of environmental media to which on-site receptors could be exposed, contaminant migration pathways and potential exposure pathways such as dermal contact, inhalation and/or ingestion.

3.1.1 Excavating Laborers

Subsurface excavation work is seldom undertaken at the MacDermid Huntingdon Avenue facility. However, if excavation work is conducted, it could entail maintaining existing utility lines and/or installation of new equipment. Potential exposures excavating laborers may encounter include soil (shallow and deep) and potentially affected air within an excavation.

Maintenance of this nature is conducted by non-MacDermid personnel. In order to minimize the potential for exposure, an institutional control system will be established. This system is discussed in Section 3.3. As a result of this system, work that may result in the contact with hazardous waste is conducted by environmental contractors under an appropriate health and safety plan. As this institutional control system has not been established, it is identified as a gap and addressed in the work plan, included as Appendix B.

3.1.2 Groundskeepers

Routine Site maintenance at the Huntingdon Avenue facility is conducted by off-site contractors using standard groundskeeping equipment such as lawn mowers and string trimmers. During routine grounds maintenance, groundskeeping personnel could potentially be exposed to surface soil periodically. Since groundwater is not used on-site for irrigation or other purposes and is approximately 30 feet below grade, potential exposure to groundwater is not a feasible pathway.

3.1.3 Indoor Workers

The workers at the Huntingdon Avenue facility spend all or most of their time indoors in the three buildings at the Site. These workers include office personnel, routinely located in the Huntingdon Avenue building, and warehousing and maintenance workers who spend the majority of their time in either the Gear Street Building or the East Aurora Street Building. These buildings are multi-storied, each equipped with a central heating ventilation and air conditioning system that exchanges air in the buildings. Occupants of each building could potentially be exposed to indoor air affected by volatilization from soils beneath the buildings. Since groundwater is approximately 30 feet below grade, volatilization from groundwater is not a feasible pathway. Indoor workers do not come into direct contact with surface soils at the Huntingdon Avenue facility because they are indoors. In instances when indoor workers may be outdoors, the majority of areas that could offer opportunity for direct contact with soil are either paved or covered with grass.

3.1.4 Environmental Samplers

Periodically, environmental sampling is likely to occur at the Site and would be conducted by off-site contractors. During such activities on- or off-site, environmental samplers have the potential to be exposed to soil (shallow and deep), sediment, surface water and/or groundwater. In these circumstances, environmental samplers would be trained professionals therefore potential direct exposure would be minimized by the implementation of personal protective equipment.



3.1.5 Trespassers

Trespassing is not likely to occur in or on active portions of the facility (i.e. south side of Huntingdon Avenue) due to the presence of security fencing. Trespassing is most likely to occur on the MacDermid-owned parcel located on the northern side of Huntingdon Avenue since this area is not secure. In either case, trespassers exposure would include shallow soils and exposure to known contaminated soil (i.e. metal hydroxide sludge-bearing soil) would be limited due to the presence of paved areas on the Huntingdon Avenue facility and the paved engineered cap on the MacDermid-owned parcel located north of the facility which was installed over metal hydroxide sludge waste between 1978 and 1979.

3.2 Off-Site Receptors

In developing this CSM, potential off-site exposures were evaluated. Three receptors - utility repair workers, nearby residents, and recreators were identified as potentially complete pathways. Figure 2 depicts the different types of environmental media to which off-site receptors could be exposed, contaminant migration pathways and potential exposure pathways such as dermal contact, inhalation and/or ingestion.

3.2.1 Off-Site Utility Repair Workers

Workers repairing utilities in off-site trenches (i.e. catchbasins, sewer lines) could potentially be exposed to subsurface or deep soils (defined as greater than 2 feet below grade) and trench air while undertaking repair work. Exposure to groundwater or volatilization from groundwater is unlikely since groundwater is approximately 30 feet below grade in the Site area. Exposure to shallow soils is likely; however any contamination present in shallow off-site soils would not be the result of MacDermid activities since shallow soil contamination typically occurs when a surficial contaminant release has occurred. Although there is no documentation of such a release associated with MacDermid activities, an evaluation is necessary to address the possibility that road configurations have been modified over time. Potential exposures are minimized since long term recurrence of the same individual for utility repair work is unlikely and repair frequency in one location is expected to be low.

3.2.2 Off-Site Residents

Residential properties are located to the west and northwest of the Huntingdon Avenue facility and are each supplied with potable water from the City of Waterbury. The facility and surrounding properties are located in a non-drinking water classification area (i.e. GB) and results of local well receptor surveys (HRP, 2001) have shown that there are no known active



potable water supply wells in the immediate Site area that could be impacted by potential groundwater contamination emanating from the Site. The HRP survey included properties immediately abutting the MacDermid parcel as well as those properties that lie southeast and southwest between the Naugatuck River and Steele Brook, respectively. Volatilization of contaminants in groundwater is unlikely since depth to groundwater measurements indicate groundwater is approximately 30 feet below grade. The potential pathway in this instance would involve volatilization of contaminants from impacted groundwater into the vadose zone, migration through the soil column into indoor air space and inhalation by the receptor.

The only other potential exposure for off-site residents would be from downwind dust transport from on-site soils. This exposure route is unlikely since the majority of the Site is paved with only incidental grass-covered areas located along the southern areas of the Site. Consequently, off-site resident exposure is not identified.

3.2.3 Off-Site Recreators

The MacDermid Huntingdon Avenue facility is located 0.17 and 0.2 miles from Steele Brook and the Naugatuck River, respectively. Site related groundwater could potentially affect surface water and sediment quality in each of these waterbodies; however, it should be noted that a significant number of other industrial facilities lie between the Site and these waterbodies and also discharge surface water runoff and groundwater into the brook and river. Nonetheless, recreators including sport fisherman and boaters could potentially be exposed to surface water and sediment in these rivers (Figure 2). Recreator exposure to Site contaminants via ingestion of fish that may be potentially affected by Site activity is considered here since chemicals that typically accumulate in the tissue of fish generally could be transported via groundwater.

3.3 Institutional Controls

The voluntary corrective action program allows for the use of and implementation of existing and proposed institutional controls to control potential exposures at the facility. Institutional controls that are already in place at the MacDermid Huntingdon Avenue facility include partial security fencing, building footprints and paved areas. MacDermid is also considering the implementation of an institutional control requiring an environmental, health and safety evaluation be performed prior to the performance of any activities that could result in employee or worker exposure to deep soils at the facility.

Yard areas at the Huntingdon Avenue facility are surrounded by a six-foot high steel chainlink fence, equipped with barbed wire deterrent along the top. Portions of the Site that are not surrounded by fencing use the buildings as barriers to Site access (Drawing 1). The two entrance

gates along Huntingdon Avenue are locked at all times. The chainlink fence that extends from the East Aurora Street and Gear Street intersection to the shipping and receiving building is equipped with one pedestrian gate and two vehicular gates and on-site MacDermid personnel monitor these gates within working hours.

3.4 **Security**

As stated previously, security measures at the Huntingdon Avenue facility are in place and include security fencing and guards. These measures minimize the potential for trespassers onto active areas of the Site.



4. SCREENING LEVELS FOR THE QUALITATIVE RISK ASSESSMENT

Section 3 included a discussion of the MacDermid Huntingdon Avenue Conceptual Site Model, which detailed potential receptors, environmental media and exposure pathways for the Site. Section 4 includes a discussion of screening levels and how these levels are developed for each receptor - media combination presented in Section 3.

4.1 Introduction

The first component of the VCAP risk assessment process is to complete a Qualitative Risk Assessment which is a comparison of Site contaminant concentrations to appropriate risk-based screening levels. The Qualitative Risk Assessment will screen out media, pathways and areas of the Site that are not likely to contribute significantly to overall Site risk. Screening levels to be used in the Qualitative Risk Assessment will initially include the Connecticut Remediation Standard Regulations (RSR) for media including soil, groundwater, and air. In some instances, (i.e. sediment), risk-based screening levels are not established in the RSR; therefore, alternative site screening levels must be established. In other instances, sampling of certain media (i.e. air and sediment) has not been completed and an evaluation of data gaps will be made to ensure that all human health and environmental risks are evaluated. Table 1 presents a summary of the exposure media and pathways for each receptor. Data gaps that are identified in this section will be addressed in the attached work plan (Appendix B).

4.1.1 Soil

For the purposes of evaluating potential exposures to contaminated Site soil, the RSR Industrial Commercial Direct Exposure Criteria (IDEC) will be used. As the screening levels are intended to be risk-based, existing environmental data will be compared to the RSR IDEC in areas where a particular receptor may be exposed. The proposed screening will be completed by comparing the maximum concentration to the IDEC. In areas where exposures may occur and data does not exist, a data gap will be identified. Data gaps are addressed in the work plan, included in Appendix B.

Drawing 1, Site Plan and Exposure Areas, provides a summary of all relevant and significant soil data that has been collected at the Site. As can be seen on this drawing, soil collected at the Site has been evaluated primarily in areas that are paved or covered by a building or Site structure. Shallow soil has been collected and analyzed in one location in which soil exposure could occur. The results of sampling in this location, GZ-5, suggest that volatile organic compounds (VOCs) are below laboratory detection limits. An evaluation of metals concentrations in this area was



completed; however, the laboratory analysis included only analysis of the extract using the Toxicity Characteristic Leaching Procedure (TCLP). For the purposes of establishing site screening levels, a mass analysis of metals concentrations is necessary.

The current data set for soils indicate that additional sampling is necessary to evaluate potential human health and environmental risk at the Site. This data gap and proposed sampling is included in the work plan as Appendix B.

4.1.2 Indoor Air

Indoor air exposure is unlikely since there is no potential pathway for the volatilization of contaminants in Site soil into surrounding air. Exposure to contaminants that volatilize from groundwater directly beneath the Site is not considered since depth to groundwater beneath the Site is approximately 30 feet below grade. For the purpose of the Qualitative Risk Assessment screening, groundwater quality data from on-site monitoring wells that are nearest abutting residential properties will be compared to the RSR Residential Volatilization Criteria (RVC) to provide a conservative evaluation of potential risk to off-site receptors (i.e. residence), although these risks are minimized due to the significant depth to groundwater at the Site (i.e. ~30 feet below grade). Potential exposure pathways under this condition would involve volatilization of contaminants from impacted groundwater into the vadose zone, migration through the soil column into indoor air space and inhalation by the receptor.

4.1.3 Surface Water

Exposure to surface water, as outlined in the CSM, can potentially occur near the MacDermid facility in the Naugatuck River and/or Steele Brook. The surface water quality can potentially be impacted by groundwater discharge from contaminated areas on the Site and those properties that lie between the Site and the points of discharge. Human receptors including environmental samplers and off-site recreators could have dermal contact with contaminants in surface water and potentially through ingestion of fish in the case of recreators. The screening criteria to be used in the Qualitative Risk Assessment will include the Surface Water Protection Criteria (SWPC) of the RSR. Additionally, if any compounds identified as a constituent of concern at the Site have the potential to bioaccumulate, then these compounds will be included in the second portion of the risk assessment process, the Quantitative Risk Assessment.

The SWPC of the RSR were developed for the protection of aquatic life and human health. The lower of the aquatic life or human health protection criteria will be used as the surface water screening criteria for the MacDermid facility to provide a conservative evaluation of potential exposures to contaminants in surface water.

Surface water samples have not been collected with respect to the MacDermid property; however, an evaluation of groundwater quality leaving the Site is necessary first to determine if a potential impact from contaminated groundwater discharging to surface water is likely.

4.1.4 Groundwater

Direct groundwater ingestion is not a pathway of concern because no drinking water supply wells are located at the MacDermid facility or immediately surrounding properties. Contaminated groundwater would not likely affect indoor air since depth to groundwater is approximately 30 feet below grade. Groundwater discharging to surface water and dermal contact with groundwater are considered potential pathways for contact with Site contaminants. Potential receptors who may have dermal contact with groundwater include environmental samplers.

Connecticut DEP has established groundwater criteria that are designed to protect surface water (i.e. Surface Water Protection Criteria). These criteria will be used as the site-specific screening levels. The DEP established the SWPC by using the lower of the water quality criteria for aquatic life or human health for each compound. For contaminants that have no established DEP-derived SWPC, a contaminant-specific criterion will be developed using the algorithms included in the RSR.

Groundwater sampling was conducted at the Site in 1995 and 2001. According to the February 11, 2002 EPA correspondence, groundwater sampling was also been conducted at the Site in 1987, 1988, 1992, 1993 and 1994; however this data has not been evaluated. During the 1995 and 2001 sampling rounds, groundwater was analyzed for metals (arsenic, cadmium, copper, lead, mercury, selenium, silver, and zinc), volatile organic compounds, total cyanide, amenable cyanide and fluoride. During the 2001 sampling event, groundwater was also analyzed for total petroleum hydrocarbons. The data obtained during these two sampling rounds indicates that concentrations of metals including arsenic, cadmium, copper, lead, mercury, selenium, silver, and zinc and total cyanide have been detected on one or more occasion in on-site groundwater monitoring wells above the respective surface water protection criteria (SWPC) in the RSR. The most downgradient monitoring wells exhibited concentrations of zinc above the SWPC during the 2001 sampling event.

Although the groundwater data collected to date provides a limited understanding of groundwater conditions at the Site, use of the data is limited since specific collection techniques and analytical methodologies are unknown. For example, it is unknown if groundwater sampling was conducted using low-flow purge and collection techniques and if groundwater samples were analyzed for total or dissolved metals.

Although groundwater samples have been collected from the MacDermid property, additional sampling is necessary to address collection techniques and to include any tentatively identified compounds; therefore this has been identified as a data gap and is addressed through proposed sampling outlined in the work plan, included as Appendix B

4.1.5 Sediment

Exposure to sediment, as outlined in the CSM, can potentially occur near the MacDermid facility in the Naugatuck River and/or Steele Brook. Sediment quality can potentially be impacted by groundwater discharge from contaminated areas on the Site and those properties that lie between the Site and the points of discharge. Human receptors including environmental samplers and off-site recreators could have dermal contact with contaminants in sediment.

The proposed screening approach addresses human health risks resulting from potential direct contact with sediments. Another potential sediment exposure pathway consideration for humans is ingestion of fish that have been affected by contaminants that may be present in sediment. If compounds related to Site-specific releases likely to bioaccumulate in fish tissue are detected consistently in sediment samples collected from on-site surface water samples, then potential fish ingestion-related risks for the surface water will be evaluated as part of the Quantitative Risk Assessment.

Sediment sampling for the purpose of risk evaluation has not been conducted in the Naugatuck River or Steele Brook; however sediment sampling was conducted as part of a 1994 release assessment. An evaluation of groundwater quality leaving the Site is necessary first to determine if groundwater discharging to the aforementioned waterbodies has the potential to impact sediment.

4.1.6 Trench Air

One exposure scenarios discussed in this CSM is for Off-site Utility Repair Worker exposure to trench air in excavations completed off the MacDermid property. For the purpose of the Qualitative Risk Assessment screening, groundwater quality data from on-site monitoring wells that are nearest abutting residential properties will be compared to the RSR Commercial/Industrial Volatilization Criteria (IVC) to provide a conservative evaluation of potential risk to workers, although these risks are minimized due to the significant depth to groundwater at the Site (i.e. ~30 feet below grade). Worker exposure within a trench represents a worst case scenario because a trench is a restricted space and volatile emissions have the potential to accumulate to higher concentrations in a trench versus ambient air.



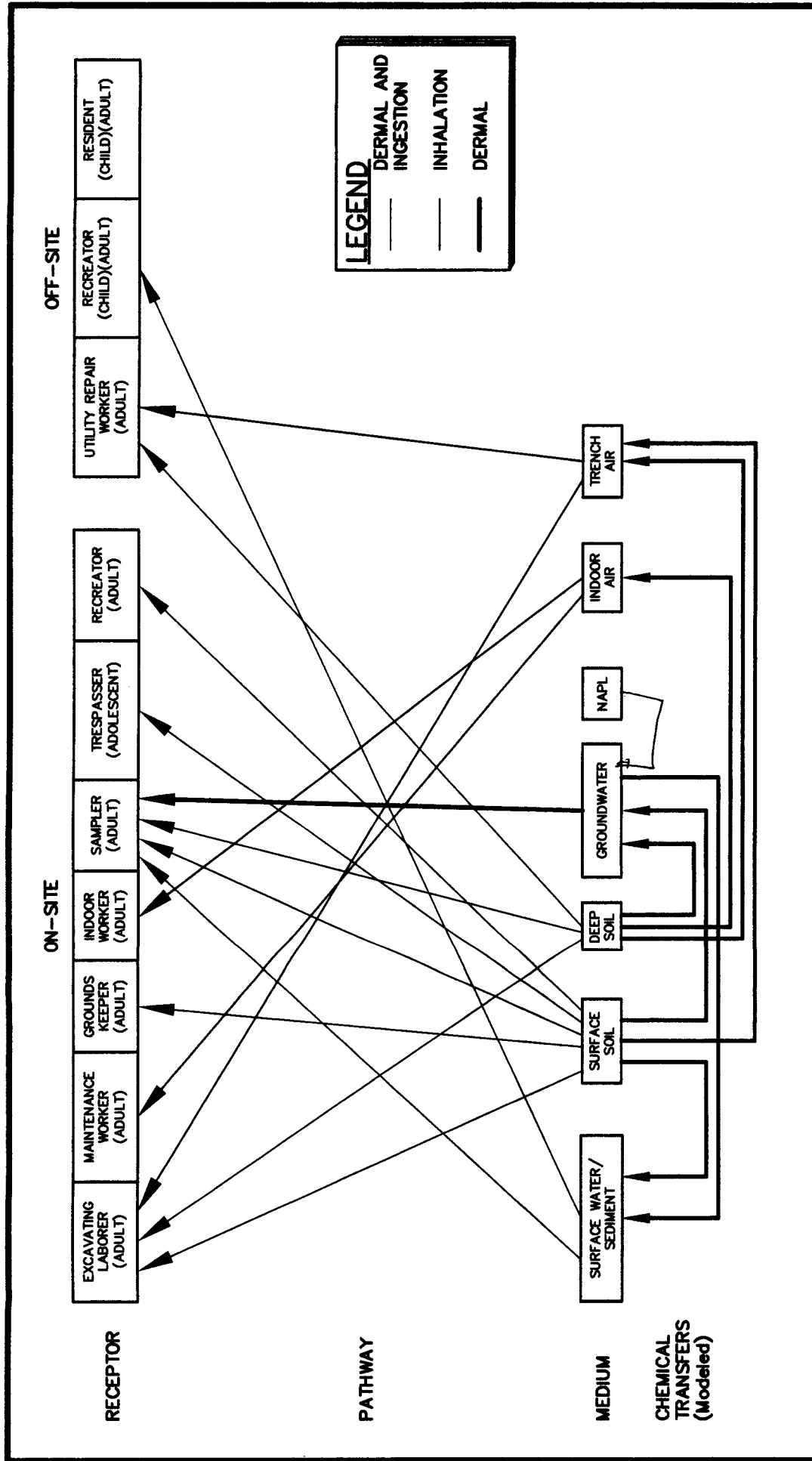
Table 1

**Summary of Screening Levels and Proposed Screening Approach
MacDermid Incorporated, Huntingdon Avenue, Waterbury, Connecticut**

Exposure Media	Soil		Indoor Air		Trench Air		Surface Water		Sediment		Groundwater	
	Exposure Pathways	Ingestion and Dermal	Inhalation	Inhalation	Inhalation	Inhalation	Ingestion and Dermal	Ingestion and Dermal	Ingestion and Dermal	Ingestion and Dermal	Derma	Derma
Proposed Approach	Excavating Laborers	YES	YES	YES	YES	YES	NO	NO	NO	NO	NO	NO
	Indoor Workers	YES	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO
	Environmental Samplers	YES	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES
	Groundskeepers	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Trespassers	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Off-Site Recreators	NO	NO	NO	NO	NO	YES	YES	YES	YES	NO	NO
	Off-Site Residents	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Off-Site Utility Workers	YES	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO
	Screening	Compare CTDEP RSR maximum to screening levels	Compare CTDEP RSR	Compare CTDEP RSR	Compare CTDEP RSR	Compare CTDEP RSR	Compare surface water and groundwater to RSR	Compare surface water to CT	Compare to screening levels	Compare to site protection criteria	Compare to surface protection criteria	Compare to water protection criteria



Figures



MACDERMID INC.
526 HUNTINGDON AVENUE, WATERBURY, CT

Comm.No.
91MW206

FIGURE 2

LEA

CONCEPTUAL SITE MODEL

Original includes color coding.

Drawings

**US EPA New England
RCRA Document Management System
Image Target Sheet**

RDMS Document ID # 100197

Facility Name: MACDERMID INC

Facility ID#: CTD001164599

Phase Classification: R-13

Purpose of Target Sheet:

☒ **Oversized (in Site File)** ☐ **Oversized (in Map Drawer)**

☐ **Page(s) Missing (Please Specify Below)**

☐ **Privileged** ☐ **Other (Provide
Purpose Below)**

Description of Oversized Material, if applicable:

DRAWING 1: SITE PLAN AND EXPOSURE AREAS

☒ **Map** ☐ **Photograph** ☐ **Other (Specify Below)**

*** Please Contact the EPA New England RCRA Records Center to View This Document ***

APPENDIX A

February 11, 2002 United States Environmental Protection Agency Correspondence



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
1 CONGRESS STREET, SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

February 11, 2002

Mr. Tom Siegrist
Macdermid Inc.
245 Freight Street
Waterbury, CT 06702

Re: RCRA Corrective Action Stabilization Report Macdermid Incorporated, 526 Huntingdon Avenue, Waterbury, CT (CID001164599)

Dear Mr. Siegrist:

Thank you for preparing and submitting a Response to the Environmental Protection Agency's (EPA) comments on the RCRA Corrective Action Stabilization Report, dated March 16, 2001.

The EPA has completed a review of the Stabilization Report and a summary of any comments and questions is contained in Attachment 1. Additional comments are contained in Attachment 2. Please provide a work plan within 60 days, designed to close the data gaps identified for each AOC and all other necessary work with respect to meeting the two Environmental Indicators. The work plan should include complete sampling, analytical and QA/QC plans and procedures for the work. Also submit a detailed schedule for all the proposed work.

Institutional Controls should be proposed as necessary for areas that are inaccessible to direct human exposure due to pavement or buildings. Access to soils beneath pavement and buildings can be restricted by institutional controls in order to meet the HEC FI without the need for the collection of additional data. The institutional controls should specify that no disturbance of the pavement or buildings is allowed until a determination has been made that there is no risk from exposure to soils. It should also specify that the existing data will be reviewed and additional data will be collected as necessary before any digging, excavation and/or demolishing of any structures occurs. Also, specify what plans are in place to ensure that all employees or persons who may be involved with such activity are notified, understand, and maintain awareness of the controls.

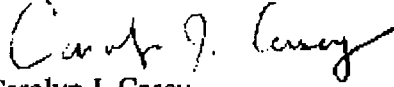
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Please contact me at (617) 918-1368 if you have any questions.

Sincerely,

A handwritten signature in cursive script, appearing to read "Carolyn J. Casey".

Carolyn J. Casey
RCRA Facility Manager

cc: M. Crawford, CTDEP
R. McFee, HRP
J. Wellington, Carmody & Torrance

ATTACHMENT 1

Please note: EPA's initial comments are contained in italic print. Comments on MacDermid's response are in regular type. MacDermid's numbering scheme is used.

General Comments

1. *Please show MacDermid's property line on an appropriately scaled map. Include all property on the north side of Huntingdon Avenue.*

The North West corner of the map notes "Other Land of MacDermid Incorporated" Please verify if this is owned by MacDermid and include within the highlighted area as appropriate or document that it is no longer owned by MacDermid.

2. *Please verify if the two rusted 55-gallon drums located north of AOC-A are on MacDermid's property. Even if they are not, a release from this disposal area, hydraulically upgradient of MacDermid property, could be impacting groundwater at AOC-A and some follow-up may be necessary.*

Plans for removal and proper disposal of the drums and any contaminated material beneath them should begin immediately. Please include the proposed work in a schedule and submit a work plan with complete sampling, analytical and QA/QC plans and procedures for the work.

3. *There was obvious trespassing in the area of AOC-A based on the remnants of the bonfire, broken bottles and plastic cups in the area. MacDermid should consider available options for securing this property in consideration of potential trespasser exposure and general liability.*

No additional comments.

4. *Generally, if it is unknown if surface water poses a risk to recreators, it would also be unknown if sediment poses a risk, unless there was data to support that no risk exists.*

Please add Steel Brook to any discussions about the Naugatuck River. Both are equal distance from the site (only 1000 feet from several AOCs according to Figure 2). Less than 1/4 mile is not a significant distance with respect to contaminant migration. Both streams have the potential to be impacted from contaminated groundwater discharge and other historic releases. Furthermore, files contain information about a 1991 release of 7,000 gallons from a WWTS holding tank to the Naugatuck River and a 1994 release of copper etchant solution (1,500 gallons) to the Naugatuck River (approximately 12,000 fish killed the day of the 1994 release). Documentation also shows that in 1990 drums containing spent copper etchant were washed at the loading dock and the wash-water was

released to Steele Brook via a catch basin and storm drain system, and chemical spills into Steele Brook via storm sewer or WWTS sewer.

5. *Please provide copies of available aerial photographs.*

Please provide photographic copies of all available aerial photographs. Also include a color photographic copy of the aerial photograph that is hanging on the wall of the facility

6. *For UST areas where fuel oils were/are stored, total petroleum hydrocarbons and polycyclic aromatic hydrocarbons should be included in the analysis. If not previously included, the lack of this analysis should be listed as a data gap so that this analysis will be included in future sampling.*

No additional comment.

7. *Any tentatively identified compounds (TICs) should be noted and discussed.*

No additional comment.

8. *In the tables showing Contaminated Media, in the rationale column for each AOC where the CTDEP RSR volatilization criteria is mentioned, please be more specific as to which criteria was used for comparison (i.e., residential and/or industrial).*

Regarding monitoring well data at the property boundary, particularly for wells located adjacent to residential properties (e.g., Gear Street), it would be more appropriate to use the residential volatilization criteria than industrial/commercial. Such a screen may be on the protective side (dependent primarily on the depth of contamination and actual distance to homes), but provides a screening approach to evaluate the potential for off-site indoor air issue from groundwater contamination.

9. *A data gap should be identified for each AOC Contaminated Media table where the "unknown" column is checked unless it is clear that no pathway exists (e.g., For AOC G Groundwater Control, there is a SWPC exceedance for zinc but the lack of any surface water data is not listed as a data gap).*

Soil contamination should be included as a data gap for many AOCs because either no data exists or very limited data exists (one sample in many cases). Although a pathway may not exist for some of these AOCs as the areas are covered w/pavement or buildings, without the history of a unit (have the floor trenches always discharged to the WWTS and have they always been epoxy coated?), the data gaps still exist. For example, at AOC-D: concrete trenches are not impermeable and are often times the source of sub-slab soil contamination, particularly those that may remain wet for periods of time due to the

nature of the processes. Other examples include AOC-A, AOC-F, AOC-K, etc.

In certain cases where institutional controls are used to prevent access to soils beneath building slabs/pavement by restricting any digging or excavating, identifying potential soil contamination data gaps does not mean that sampling will necessarily be required to meet the EIs.

10. *Text summaries of contamination detected for each AOC should also include visual and olfactory observations and elevated PID readings (e.g., Boring log for GZ-3 notes CINDERS/ASH (FILL) from .5-2.5 foot depth; boring logs for GZ-8 and GZ-9 note spoils had a sweet odor; and boring log for GZ-8 also notes sample S-8 was copper colored).*

On page 24, the text summary does not note that sample S-8 from MW-109 (formerly GZ-8) was stained copper colored. Also the last paragraph mentions PID reading of < 0.9 ppm yet the boring log for MW-109 shows a reading of 5.1 ppm. Please revisit this comment again.

Specific Comments

Section 1.2, page 2

1. *Please revise this paragraph to more accurately reflect that the Gear Street building was used for the manufacturing of inks but that this operation rarely or no-longer takes place at the facility.*

No additional comment.

Section 2.1, page 7

2. *Please clarify if AOC-A was used prior to 1978/1979 time frame when it was reportedly used by MacDermid. If so, also include information about who used the AOC and for what reasons (i.e., Was this area used by Waterbury Steel Ball Company?).*

No additional comment.

page 9

3. *The information regarding surface water results contained in the fourth row and column of this table conflicts with that presented in Table 3. Please correct the tables as appropriate.*

No additional comment.

page 11

4. *The lateral extent of the cover for this area should also be identified as a data gap as noted on page 10 under the rationale for surficial soil.*

No additional comment.

Section 2.5, page 29

5. *The last statement in the second paragraph is misleading. Only one soil sample was analyzed for PCBs and the detection limits were elevated.*

EPA's above comment should have read "oil" and not "soil." Regardless, MacDermid's response was appropriate. All subsequent sampling at this well and adjacent wells should include checks for non-aqueous phase liquids and sampling and analysis should be conducted again. Lower detection limits for PCBs in waste oils should be achieved (i.e., 10 ppm or less).

Please provide a copy of the gas chromatographic trace, and a copy of the reference chromatogram for the analysis of the light non-aqueous phase petroleum product.

No additional comments.

Section 2.7, page 38

6. *The rationale for surface soil contained in this table mentions 0.013 ug/kg of PCE at TP-5. Please verify this information, table 10 shows mg/kg as the units.*

This information should be included under the row for soils > 2 feet as the sample was collected from a depth of 8-11', according to Table 10. Please verify and revise as appropriate.

The rationale for surface soil discusses SWPC but should likely be referencing the GB PMC instead.

No additional comment.

Section 2.9, page 43

7. *The last bullet states that DEP approval was requested prior to backfilling the excavation. Please provide a copy of the approval letter.*

The raw laboratory data, chain of custody sheets and field logs should be provided or referenced. What is presented in Table 15 for samples 3 and 4 does not agree with what is on page 51, Known Releases 4th bullet regarding where the sample was collected.

Tables

8. *The more conservative hexavalent chromium standard should be used instead of the trivalent standard if speciation data is not available.*

No additional comment.

In Table 1, for AOC L, please revise "transfer" to read "transformer."

No additional comment.

This table provides data for samples collected in April 1986. Please provide copies of these laboratory reports.

No additional comment.

The data contained in this table for MW-101 for sampling conducted 3/95 does not agree with the laboratory reports for MAC-6 contained in Appendix E pages 34-36 and 41. Please revise the summary tables as appropriate.

No additional comment

The data contained in Table 9 for at least MW-108 and MW-109 do not agree with the laboratory reports contained in Appendix F. In addition, vinyl chloride, chloroethane, and p-isopropyltoluene are not reported in the summary tables as being detected. Please revise the summary tables as appropriate.

Duplicate sample results should be reported in the summary tables along with the actual sample result. All duplicate results should be clearly identified as such.

The result for zinc, MW-108 sampling date 2/01 should be 0.098, not 0.048 mg/l. For the same well/date, vinyl chloride should be reported as 0.0027 ug/l, not 0.0024 (also units are missing), and o-xylene was detected at 0.0024, not 0.0027. Please verify all entries in the summary table for at least this well.

Appendix E and F

9. *The well designations in the 1995 Groundwater Data Summary for VOCs, Cyanide and Fluoride do not agree with the designations in the 1995 Groundwater Data Summary for Metals or the 2001 Groundwater Index. Please correct these tables as appropriate and verify that all tables are cross checked throughout the report and against the maps. Submit copies of the older maps showing well locations and previously used well designations.*

No additional comment

Please provide copies of the chain of custody forms for all sampling events.

No additional comment

Appendix G

February 2001 WELL RECEPTOR SURVEY

10. *There is no page 3, please verify if there is a page missing or if the pages were numbered incorrectly.*

No additional comment.

Section 4.0, page 7

11. *It is necessary to know the status of the five water supply wells identified in the 1974 State of Connecticut Water Resource Bulletin No. 19. If these wells are still in use, the uses should be known to evaluate potential exposure routes and potential human health impacts. In addition, the pumping rate and frequency of water withdrawal should be known to evaluate any potential effects on groundwater and contaminant migration.*

Again, it is necessary to obtain information on the use of water supply wells, industrial water supply wells and remediation wells to evaluate potential exposure routes, potential human health impacts and to evaluate any potential effects on groundwater and contaminant migration that pumping these wells may have.

The CTDEP and/or the EPA may have monitoring well data in the files for some of the other facilities (e.g., 346 Huntingdon Ave, 172 and 237 E. Aurora St). This information may be useful to MacDermid in evaluating whether or not there are any off-site impacts.

Figure 2

12. *There are several lots where no information is provided, not even a lot number. Please clarify if these lots are vacant and if this was confirmed by a visual inspection.*

No additional comments at this time.

ATTACHMENT 2

Additional General Comments:

1. As a reminder, please notify EPA as soon as possible, and at least one week, in advance of the initiation of any field work.
2. The tables contain an incorrect Industrial/Commercial Volatilization Criteria for vinyl chloride in groundwater. The value is 0.002 mg/l, not 6.1 mg/l. Please revise and bold/shade any results that exceed the criteria.
3. Sampling should be conducted using the July 30, 1996, EPA Region 1 Low Stress (low flow) Purging and Sampling Procedures. Total metals (unfiltered samples) should be collected. Sampling conducted in 2001 did not follow the low-flow sampling procedures; the chain of custody forms indicate that the samples were filtered in the field with the exception of MAC-1. MacDermid may still choose to collect filtered samples, but this should be done in addition to collecting unfiltered samples for total metals analysis. Please refer to Attachment 3.

Regarding MAC-1, although the chain of custody form states that total metals are to be analyzed, the lab reports the results as dissolved. Please clarify this apparent discrepancy.
4. Since a work plan was not submitted prior to the sampling, we have no specific information about the sampling procedures used to collect the 2001 data. Please include a summary of the procedures used.
5. Dates provided on the laboratory data sheet indicating when the samples were collected and received by the laboratory are not correct. They show samples were received before the date collected (pages 7-36, Appendix F of the original report). It is not necessary to resubmit these reports but the lab should be informed of this error so that it is not repeated.
6. For future reference, it is not appropriate to change well designations. This makes the review of any older data, boring logs and maps very cumbersome. It may also result in the loss of data over time. Errors were introduced into the summary tables when the well designations were changed; this was not likely to have happened otherwise. The old designations are useful in some respect as they can help to identify who did the work, how many different consultants worked on the site, approximate time frame that the wells were installed.
7. Nested wells (wells at depth) are needed to determine the vertical extent of contamination.

8. A significant amount of additional groundwater sampling has taken place and should be included in the summary tables. In addition, laboratory reports and chain of custody forms for this data should be provided. According to the files, groundwater sampling was also conducted in 8/87, 1/88, 10/88, 10/92, 2/93, and twice 1/94.
9. All available soil/sediment data does not appear to have been summarized in the tables. For example, AOC-K2, the last paragraph on page 58 references Tables 4 and 5 of Appendix M; the soil data contained in Appendix M is not summarized in the tables. Furthermore, the data for one soil sample that is included in Table 17 for AOC-K should, at a minimum, include a sampling date so that the chain of custody and lab reports can be located without too much difficulty. Another example is AOC-E where the sediment data (Appendix K) from Steele Brook and the Naugatuck River have not been summarized.
10. Page 37 of the 2001 lab report indicates that the equipment blank was filtered. This should not be done. The point of collecting this sample is to determine the effectiveness of the decontamination procedures. Filtering interferes with the representativeness of the sample for its intended purpose.
11. The AOC descriptions lack any historical information. For example, on page 61 AOC-K5 - Ink Manufacturing Area: Information regarding potential releases lists only the current containment structure and that the collection sump discharges to the waste water treatment system. Historic information regarding the potential for releases prior to installation of the secondary containment systems and connection to the WWTS should be discussed. Please state whether or not secondary containment and WWTS discharge have been in place throughout the existence of the area. Other examples include AOC-D, AOC-H, AOC-K6, AOC-K7, and AOC-K8.

Additional Specific Comments

Section 2.4, Page 19

12. In the second paragraph last sentence under potential releases, cyanide should not be listed as not detected in soils as Table 6 does not indicate that it was even included in the analyses.

Section 2.5, Page 24

13. In the last paragraph, please verify that MW-8 and MW-9 should read GZ-8 and GZ-9. Also, if this is the case and these wells were renamed, the new designations, MW-109 and MW-108 respectively, should be used. This should be done consistently, throughout the document.

Section 2.5, Page 34

14. The rationale provided for surface soil should be revised from "subsurface soil" to "surface soils."

15. For sediment, the rationale should discuss that the 1994 sampling results (Appendix K) indicate that Steel Brook sediment is likely impacted, particularly in the area of sample number one (at the outfall) and from copper.

TABLES

16. The detection limit with a less than sign, not "ND" or "BDL" should be included in the summary tables. Alternately, detection limits can be included as an additional column. If "BDL" means that the constituent was detected at a level that is less than the reporting limit, this result should be estimated and qualified with a "J."
17. Several tables (e.g., 6, 8, 11, 13) include the note "...Detection limits ranged from 5 ug/mg to 125 ug/mg." Please revise as appropriate.
18. All tables of data should include the date the samples were collected (refer to Tables 4, 6 8, etc.).

Table 10

19. Bold/Shaded results should be defined in the notes as exceeding Pollutant Mobility Criteria, not Surface Water Protection Criteria. This is also the case for Tables 11 and 13. Please verify all tables contain the correct notes.
20. A constituent is listed as 1,1,1-Trichloroethylene, please revise as appropriate.

Appendix M

21. Chain of custody forms and lab results for soil samples collected in 2000, indicate that leachability of metals from soil was analyzed using EP Toxicity leaching procedures. This method has been out of date for many years now and is inappropriate for use in characterizing a solid waste and/or soil leachate concentrations. TCLP should be used for waste determinations and TCLP or SPLP should be used for determining compliance with the CTDEP RSRs.
22. The tables contain incorrect standards for nickel direct exposure, cadmium leachate, TCE direct exposure and leachate. Please verify all standards are current and correct.
23. Page 2 of this Closure Summary refers to Appendix A which only includes TCLP results for one sample. One sample is not typically sufficient to make a determination regarding whether or not a waste is characteristically hazardous.

ATTACHMENT 3

**EPA Region 1 Low Stress (low flow)
Purging and Sampling Procedures
July 30, 1996**

APPENDIX B

Voluntary Corrective Action Program Work Plan (May 2002)

**VOLUNTARY CORRECTIVE ACTION PROGRAM
WORK PLAN**

**MacDermid, Incorporated
Waterbury, Connecticut**

May 2002

Prepared for

**MACDERMID, INC.
245 Freight Street
Waterbury, Connecticut**

Prepared by

**LOUREIRO ENGINEERING ASSOCIATES, INC.
An Employee Owned Company
100 Northwest Drive
Plainville, Connecticut**

Comm. No. 91MW206

Table of Contents

	Page
1. OBJECTIVE	1-1
2. PROPOSED ACTIVITIES	2-2
2.1 Environmental Activities	2-2
2.1.1 Surface Soil	2-2
2.1.2 Groundwater	2-2
2.2 Historical Evaluation Activities	2-4
2.2.1 Aerial Photograph Review	2-4
2.2.2 Sanborn Fire Insurance Map Review	2-4
2.3 Evaluation of Institutional Control Measures	2-4
3. QA/QC SUMMARY AND DATA MANAGEMENT	3-6
3.1 Standard Operating Procedures	3-6
3.2 Sample Collection	3-6
3.2.1 Field Sample Collection Procedures	3-6
3.3 Sampling Quality Control	3-7
3.3.1 Equipment Blank	3-7
3.3.2 Field Duplicates	3-7
3.3.3 Trip Blanks	3-7
3.3.4 Field / Laboratory QC Samples	3-8
3.3.5 Chain-of-Custody	3-8
3.3.6 Sample Shipping	3-8
3.3.7 Decontamination	3-8
4. PROJECT SCHEDULE AND REPORTING	4-9
4.1 Project Schedule	4-9
4.2 Reporting	4-9



LIST OF DRAWINGS

DRAWING	TITLE
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Drawing 1	Proposed Sampling Locations
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LIST OF APPENDICES

APPENDIX	TITLE
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A	Standard Operating Procedures
B	Project Schedule



1. OBJECTIVE

The purpose of this Voluntary Corrective Action Program (VCAP) Work Plan is to provide the data to support stabilization of the MacDermid, Inc. (MacDermid) facility located at 526 Huntingdon Avenue in Waterbury, Connecticut. More specifically, this document addresses the following:

- Delineation of exposure areas for the receptors identified in the report entitled *Conceptual Site Model and Screening Levels - MacDermid Incorporated*, prepared by Loureiro Engineering Associates, Inc. (LEA) in May 2002.
- Provides an assessment of all existing data currently available within the exposure areas identified. The existing data was obtained from the *RCRA Corrective Action Stabilization Report*, completed by HRP Associates, Inc. on March 16, 2001.
- Proposes sampling in response to data gaps identified.

The objectives and rationale for the proposed sampling are described in this work plan by media. The exposure areas identified and sampling locations are shown in Drawing No. 1 attached to this document. In certain instances, it was determined that data is required to address data gaps.



2. PROPOSED ACTIVITIES

In order to achieve stabilization at the MacDermid Huntingdon Avenue facility, all environmental media (soil, sediment, surface water, groundwater, air) must be evaluated against risk-based criteria to determine if a human health risk and/or an environmental risk are present. An evaluation of existing, available relevant and significant data indicate that several data gaps are present for some media evaluated at the facility. In addition, historical information review is necessary to complete a comprehensive risk assessment at the MacDermid facility. The following provides a discussion of those data gaps for both environmental and administrative (i.e. historical site information) and proposed sampling and activities to address those gaps.

2.1 Environmental Activities

2.1.1 Surface Soil

Receptors and exposure pathways for soil were identified in the report entitled *Conceptual Site Model and Screening Levels - MacDermid Incorporated*, prepared by LEA in May 2002. Exposure to soil via ingestion and dermal contact may occur for Excavating Laborers, Groundskeepers, and Environmental Samplers. An evaluation of existing data was performed and it was determined that additional samples are necessary to support stabilization since surface soil sampling was limited to one grass and soil exposed area. The remainder of surface soil sampling was conducted beneath asphalt or building footprints. All existing data within the areas of exposure identified in Drawing No. 1 will be used. The existing sample to be used is GZ-5 and the new samples to be collected will be SB-001, SB-002, SB-003 and SB-004.

The proposed samples will be collected from the upper six inches of soil and analyzed for the following constituents: Volatile organic compounds (VOCs), metals, cyanide, and total petroleum hydrocarbons (TPH). Metals will include arsenic, barium, cadmium, chromium (total), hexavalent chromium, copper, lead, mercury, nickel, selenium, silver, tin (a tentatively identified compound) and zinc. In addition to these samples, quality assurance/quality control (QA/QC) samples including equipment blanks, trip blanks, and duplicates will also be collected. A discussion of QA/QC procedures and applicable Standard Operating Procedures (SOPs) included in Section 3.

2.1.2 Groundwater

Receptor and exposure pathways for groundwater were identified in the report entitled *Conceptual Site Model and Screening Levels - MacDermid Incorporated*, prepared by LEA in

May 2002. The exposure pathways identified include: direct exposure to groundwater (dermal contact) and exposure to surface water that has been impacted by contaminated groundwater.

Exposure to contaminated groundwater via dermal contact is not being considered since the only receptor would be environmental samplers. In this instance, the environmental sampler would be a trained professional and familiar with the mechanisms for limiting dermal contact with groundwater. Exposure to surface water via ingestion and dermal contact is possible for off-site recreators and environmental samplers.

Groundwater sampling was conducted at the Site in 1995 and in 2001. During these two sampling rounds, groundwater was analyzed for metals, VOCs, total cyanide, amenable cyanide and fluoride. Metals included arsenic, barium, cadmium, chromium, copper, lead, nickel, mercury, nickel, selenium, silver, and zinc. During the 2001 sampling event, groundwater samples were also analyzed for TPH. The data obtained during these two sampling rounds indicates that concentrations of metals including arsenic, cadmium, copper, lead, mercury, selenium, silver, and zinc and total cyanide have been detected on one or more occasion in on-site groundwater monitoring wells above the respective tabulated surface water protection criteria (SWPC) in the Connecticut Remediation Standard Regulations (RSR). The most downgradient monitoring wells exhibited concentrations of zinc above the tabulated SWPC during the 2001 sampling event.

Although the groundwater data collected to date provides a limited understanding of groundwater conditions at the Site, use of the data is limited since specific collection techniques and analytical methodologies are unknown. For example, it is unknown if groundwater sampling was conducted using low-flow purge and collection techniques and if groundwater samples were analyzed for total or dissolved metals.

The proposed sampling will include collection of groundwater samples from each on-site monitoring well. Analysis for each groundwater sample will include: VOCs, metals, cyanide, and TPH. Metals will include arsenic, barium, cadmium, chromium (total), hexavalent chromium, copper, lead, mercury, nickel, selenium, silver, tin (a tentatively identified compound) and zinc. In addition to these samples, QA/QC samples including equipment blanks, trip blanks, and duplicates will also be collected. Groundwater samples will be collected using low-flow, low stress techniques to minimize sedimentation in the samples and thereby limit potential interference.

In addition to completing a round of groundwater sampling at the MacDermid facility, LEA will identify and review any additional groundwater sampling results that are relevant and significant to the stabilization process and complete a locational and elevational survey of all existing well

locations to be used in evaluation of groundwater flow direction. According to the February 11, 2002 United States Environmental Protection Agency (EPA) correspondence to HRP Associates, Inc., groundwater sampling was conducted at the site in 1987, 1988, 1992, 1993, and 1994. This information will be used to complete an evaluation of potential human health and environmental risks at and resulting from the MacDermid property.

The results of this round of groundwater sampling will be used to determine if a potential exists for impact to the surface water and sediment of the Naugatuck River and Steele Brook. Therefore, at this time, no surface water sampling or sediment sampling is proposed.

2.2 Historical Evaluation Activities

2.2.1 Aerial Photograph Review

Aerial photographs for the years 1934, 1951, 1965, 1970, 1975, 1980, 1986, 1990, 1995 and 2000 are available for review at the Connecticut Department of Environmental Protection (DEP). LEA will complete a review of all available aerial photographs from the DEP and conduct a review at local offices including the City of Waterbury Engineering Department and the City of Waterbury Planning and Zoning Department. The information obtained from the review will be used to complete an assessment of potential exposure areas identified in the Conceptual Site Model and Screening Levels completed by LEA in May 2002.

2.2.2 Sanborn Fire Insurance Map Review

In order to gain an understanding of historical site features and activities, an evaluation of available Sanborn Fire Insurance Maps will be conducted. The information obtained from the review will be used to complete an assessment of potential exposure areas identified in the *Conceptual Site Model and Screening Levels* completed by LEA in May 2002.

2.3 Evaluation of Institutional Control Measures

The voluntary corrective action program allows for the use and implementation of existing and proposed institutional controls to control and limit potential exposures at the facility. Although some institutional controls are in place at the facility, additional measures may be necessary to control receptor exposure. MacDermid is also considering the implementation of an institutional control requiring an environmental, health and safety evaluation be performed prior to the performance of any activities that could result in employee or worker exposure to deep soils at the facility. Each existing potential exposure area and receptor characteristics will be evaluated to determine where institutional control measures could be implemented. For example, existing

grass-covered areas located on the MacDermid property may be paved to eliminate the exposure potential to receptors such as groundskeepers or environmental samplers.



3. QA/QC SUMMARY AND DATA MANAGEMENT

This section has been organized to present those activities which will be performed by personnel to document the record of sampling activities performed in the field and to discuss the QA/QC activities to be performed in the field.

3.1 Standard Operating Procedures

Standard Operating Procedures (SOPs) have been developed for the most common procedures associated with the monitoring, sampling and analysis of various media for the risk assessment evaluation. Development of these SOPs has taken into account the need for precision, accuracy, completeness, representativeness and comparability of data.

Each SOP was developed by personnel experienced in the performance of the specific activity. At least two senior-level people, one an officer of the company, reviewed the SOP to ensure that the identified procedures satisfy the stated objectives and that the prescribed procedures are technically correct, appropriately applied, and in conformance with applicable regulatory criteria and standard practices. These individuals signified their approval by signing and dating the SOP.

SOPs for the following activities have been included in Appendix A:

- Soil Sampling
- Hand Auger Borings
- Liquid Sample Collection and Field Analysis
- Low Flow Groundwater Sampling
- Quality Assurance/Quality Control Measures for Field Activities

3.2 Sample Collection

Field sample tracking activities will focus on the timely assignment and tracking of information relevant to field samples collected during the investigation activities. This information included sample identifiers, sample locations, Chain-of-Custody information, and sample characteristics. *Specific sample tracking procedures employed during the investigation activities will be the same as those detailed in the SOPs.*

3.2.1 Field Sample Collection Procedures



During the course of site sampling activities, numerous samples of soil and groundwater will be collected by field personnel. All samples will be collected in accordance with the SOPs provided in Appendix A of this report.

In addition to the various matrix sampling to be conducted at the site, several types of QA samples will be collected to confirm the reliability and validity of the field data gathered during the course of the investigations. Field duplicate/replicate samples of soil and groundwater will be used to provide a measurement of the consistency of samples from the same sampling station and an estimate of variance and bias. Blanks (as described below) will be used to provide a measurement of potential cross-contamination sources and decontamination efficiency. A discussion of the QA sample collection approach is presented below.

3.3 Sampling Quality Control

In addition to periodic calibration of field equipment and appropriate documentation as outlined in the attached SOPs, quality control samples will be collected or generated during sampling activities. Quality control samples include field duplicates and blanks. Each type of field quality control sample is defined below.

3.3.1 Equipment Blank

Equipment blanks will be obtained under representative field conditions by running analyte-free deionized water through sample collection equipment after decontamination and placing it in the appropriate sample containers for analysis. Sample preservatives will be added to the equipment blanks. These samples will be used to assess the effectiveness of decontamination procedures. Equipment blanks will be collected at a rate of one in twenty samples, per matrix, or one per sampling event if fewer than twenty samples are collected.

3.3.2 Field Duplicates

Field duplicates will be submitted at the rate of one for every twenty samples, per matrix. Field duplicates will be collected as collocated samples. Field duplicates provide precision information regarding homogeneity and distribution of the contaminants; they measure the bias of sub-sampling.

3.3.3 Trip Blanks

Trip blanks will be collected at a frequency of one per day in which the collection of VOCs is performed. Trip blanks will be prepared by the laboratory at the time sample containers are provided to the site. The trip blank will accompany the samples through sample collection and



transportation. The trip blank will not be opened at the site, as it serves to assess sample conditions related to sample transport, shipping, or site conditions.

3.3.4 Field / Laboratory QC Samples

Additional sample volume will be collected for one of every 20 samples per analysis for the purposes of laboratory quality control.

3.3.5 Chain-of-Custody

As noted above, samples of various media will be collected during the sampling activities to be conducted at the site. Chain-of-Custody procedures will be used to maintain and document sample possession from collection through analysis. For this reason, the possession of samples will be traceable from the time the samples are collected until they are analyzed. The following documents will identify samples and document possession:

- Sample labels
- Chain-of-Custody record forms
- Appropriate Field Record forms.

The field sampler will be responsible for the care and custody of the samples collected until they are hand-delivered to the laboratories under the Chain-of-Custody procedures. Specific Chain-of-Custody procedures are described in the specific SOPs contained herein.

3.3.6 Sample Shipping

Following sample collection, the filled sample containers will be placed in coolers packed appropriately to avoid bottle breakage. Freezer packs or ice, packed in zip-locked bags or plastic containers, will be placed in the coolers to keep the samples at a temperature not exceeding 4° Celsius during transport to the laboratories. Samples will be hand-delivered and relinquished to a state-certified analytical laboratory by LEA personnel at the end of each sampling day.

3.3.7 Decontamination

Decontamination procedures are described in applicable SOPs included with this work plan. These procedures are designed to avoid cross-contamination between samples, the transport of contaminated material between on-site locations, and the transport of contaminated material from off-site locations to the site or from the site to the off-site locations. As described in Section 3.3.1, equipment blank samples were collected to confirm the efficiency of decontamination procedures.



4. PROJECT SCHEDULE AND REPORTING

4.1 Project Schedule

A project schedule has been developed for the supplemental subsurface investigation and is included as Appendix B. The schedule, which includes the major tasks to be performed during that investigation, will be used to track overall progress of the project. The schedule presents the projected start dates, duration, and dependencies of the major tasks and subtasks. This schedule will be updated should conditions change during the course of the project.

4.2 Reporting

The data obtained during these site evaluation activities will be summarized on the appropriate Environmental Indicator Determination forms and submitted to the EPA. The reporting schedule is identified on the aforementioned project schedule.



Drawings

**US EPA New England
RCRA Document Management System
Image Target Sheet**

RDMS Document ID # 100197

Facility Name: MACDERMID INC

Facility ID#: CTD001164599

Phase Classification: R-13

Purpose of Target Sheet:

☒ **Oversized (in Site File)** ☐ **Oversized (in Map Drawer)**

☐ **Page(s) Missing (Please Specify Below)**

☐ **Privileged** ☐ **Other (Provide
Purpose Below)**

Description of Oversized Material, if applicable:

DRAWING 1: PROPOSED SAMPLING LOCATIONS

☒ **Map** ☐ **Photograph** ☐ **Other (Specify Below)**

*** Please Contact the EPA New England RCRA Records Center to View This Document ***

APPENDIX A

Standard Operating Procedures

Loureiro Engineering Associates, Inc.
Standard Operating Procedure
for
Liquid Sample Collection and Field Analysis

SOP ID: 10004

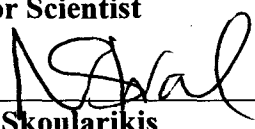
Date Initiated: 02/20/90

Revision No. 006: 12/31/01

Approved By:


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12/15/01
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12/18/01
Date

REVISION RECORD

<u>Rev #</u>	<u>Date</u>	<u>Additions/Deletions/Modifications</u>
Initial Issue	2/20/90	
001-004	NR	No record
005	01/15/99	No record
006	12/31/01	Updated to conform to new SOP format. Minor revisions throughout



Loureiro Engineering Associates, Inc.
Standard Operating Procedure
for
Liquid Sample Collection and Field Analysis

1. Purpose and Scope

This document describes procedures to be followed for measurement of static water level elevations, detection of immiscible layers, well evacuation, sample withdrawal, and field analyses.

2. Definitions

2.1. Immiscible layers: The term is used to denote free-phase liquids that may be present in the aquifer as a result of a release. These liquids may have a density lighter than water (*light non-aqueous phase liquids (LNAPL)* or floaters) or heavier than water (*dense non-aqueous phase liquids (DNAPL)* or sinkers).

3. Equipment

3.1. Equipment required for the collection and field analysis of liquid samples includes:

- Water-level indicator (accurate to 0.01 foot). The size of the instrument depends on the size of the wells being monitored.
- Distilled water.
- Hand towels.
- Portable volatile organic compound (VOC) analyzer (Photovac Microtip®, Foxboro OVA® or equivalent).
- Interface probe, clear PVC or fluorocarbon resin bailer (if required).
- pH and temperature meter (capable of accuracy to 0.1 pH unit).
- Specific conductivity meter.
- Bailers (clean or disposable) with disposable nylon or polyethylene rope.
- Polyethylene plastic sheeting.



- Polyethylene tubing, and appropriate pumping apparatus such as centrifugal pump, Wattera pump with fluorocarbon resin foot valve, peristaltic pump with appropriate tubing, submersible pump or other appropriate pumping apparatus.
- Clean disposable gloves.
- Field paperwork.
- Sample collection jars.
- Indelible marker.
- Cooler(s) with ice or ice packs.
- Site-specific Health and Safety Plan (as applicable).
- Site-specific work plan, work instructions, drawings (as applicable).
- Personal protective equipment (as may be required by Site Specific Health and Safety Plan).
- Aluminum foil (if field decontamination is expected).
- Appropriate containers for collection of purge water (bucket, carboy, 55-gallon drum etc.).

4. Procedures

Immediately upon opening the well, the air in the well head will be sampled for VOCs using a portable VOC analyzer, such as a Photovac Microtip®. The well cap shall be opened slightly and the sampling port of the VOC analyzer shall be inserted into the well. The maximum reading shall be recorded on the appropriate field paperwork. The instrument shall be zeroed with ambient air prior to the measurement, and the initial and final readings shall be recorded for each well.

Measures shall be taken during well sampling to prevent surface soils from coming in contact with the purging equipment and lines. Typically, a polyethylene sheet is placed on the ground providing adequate coverage for the equipment being used.

4.1. Detection of Immiscible Layers

- 4.1.1. If the presence of immiscible layers is suspected or unknown, the sampling event shall include provisions for detection of immiscible phases prior to well evacuation or sample collection. Lighter and/or



denser immiscible phases may be encountered in a groundwater monitoring well.

4.1.2. An interface probe will be used to determine the existence of any immiscible layers, light or dense. Alternatively, a clear fluorocarbon resin or polyvinyl chloride (PVC) bailer may be used to determine the existence of the phases or oil sheen in the well when no accurate determination of the immiscible layer thickness is required. For less than 1-inch Geoprobe® wells an interface probe cannot be introduced into the well. A small diameter disposable bailer can be used to determine the existence of any immiscible layers. Alternatively the initial water purged from a well will be collected and evaluated visually for the presence of immiscible layers.

4.1.3. If immiscible layers were encountered, the levels of the immiscible liquids shall be measured to an accuracy of 0.02 feet using an electronic interface probe capable of detecting the interfaces between air, product, and water. The interface levels shall be recorded in the field notebook. Adjustments of the observed head to the theoretical hydraulic head shall be calculated based on the density conversion factor associated with the particular non-aqueous phase liquid.

4.1.4. If required, the immiscible layers and groundwater shall then be purged into 55-gallon 17H DOT drum, which shall be labeled and characterized for disposal. The immiscible layer shall be collected prior to any purging activities.

4.2. Measurement of Static Water Level

4.2.1. The static water elevations in each well shall be measured prior to each sampling event. This is performed initially to characterize the site, and in subsequent sampling rounds to determine whether horizontal or vertical flow gradients have changed. A change in hydrologic conditions may necessitate modification of the groundwater monitoring program.

4.2.2. Remove the protective cover and locking cap.

4.2.3. Each well shall have a surveyed reference point located at the top of the well casing with the locking cap removed. The reference point shall be easily recognizable, since the personnel conducting the sampling may differ from one sampling event to the next. If no



distinguishable reference point is present, the measurements shall be taken from the highest point on the well casing. The absence of a reference point and subsequent reference point used for the measurements shall be recorded on the field paperwork.

4.2.4. The following parameters shall be measured with an accuracy of 0.01 ft:

- Depth to standing water.
- Depth to bottom of well.

4.2.5. A water-level indicator will be used for measurement. Due to possible pressure differences between the well atmosphere and the ambient atmosphere, the water level will be allowed to equilibrate for 15 minutes following removal of the well cap. The results shall be recorded on in the appropriate location(s) on the appropriate field forms.

4.2.6. Total depth measurements will be compared to original depths to determine the degree of siltation that may have occurred. This information shall be noted on the field form. Should significant siltation occur in any well, the well may need to be redeveloped by an approved method. This information will also be used to confirm that the proper well is being sampled (in case of cluster wells).

4.2.7. The portion of the tape immersed in the well shall be decontaminated during retrieval using a distilled water rinse followed by drying with a clean wipe, prior to use in another well. This decontamination procedure shall be amended, as needed, to accommodate the specific type of contamination anticipated.

4.3. Field Analysis

4.3.1. Parameters that are physically or chemically unstable shall be measured immediately after collection using a field test meter or other equipment. Parameters such as pH, temperature, specific conductivity, and turbidity will be measured in the field, at the temperature of the well sample. The measurement of additional parameters may be required dependent upon sampling methods or other site-specific conditions.



- 4.3.2. A combination of pH/temperature/conductivity meters shall be used. The meter shall be calibrated prior to use and at the end of the day using calibration solutions, in accordance with the instructions included in Attachment A to this standard operating procedure (SOP). Whenever a questionable reading ("spike") is observed the calibration shall be checked. The calibration shall be checked prior to sampling each well or well cluster. Calibration information to be recorded in the field paperwork shall include the temperature, pH, and conductivity readings in each calibration solution before and after each calibration.

The pH/temperature/conductivity meters shall be placed into a sample and allowed to stabilize for a minimum of twenty seconds. The accuracy of measurement shall be 0.1 standard units for pH, and 0.1° Celsius for temperature. For conductivity, the accuracy shall be as stipulated by the range of the instrument. The sample shall be discarded in an appropriate manner upon completion of analysis.

- 4.3.3. The pH/temperature/conductivity meters shall be decontaminated using a distilled/deionized water rinse between each sample. To the extent possible, the same probe and meter shall be used for all measurements at a given site for the duration of monitoring at the site.
- 4.3.4. Turbidity of the sample will be measured using a DRT turbidimeter, Model 15C or equivalent, that has been calibrated in accordance with the instructions provided in Attachment A to this SOP. The accuracy of the measurement shall be to 1 NTU (nephelometric turbidity unit).

4.4. Well Evacuation

- 4.4.1. Calculate standing water in the well based on the following schedule and record on the appropriate field form:



Well Diameter (inches)	Conversion Factor (gal/feet)
½	0.01
1	0.041
1 ¼	0.064
1 ½	0.091
2	0.163
4	0.654
6	1.47

- 4.4.2. Generally, a centrifugal, submersible, air-lift, bladder, inertial, or peristaltic pump equipped with a fluorocarbon resin or PVC foot valve on the end of dedicated tubing, as appropriate, may be used to evacuate the monitoring wells. Alternatively, evacuation of the wells may be accomplished using a bailer.
- 4.4.3. A new sheet of polyethylene plastic shall be placed on the ground adjacent to the well. Sampling and purging equipment, such as pump, tubing, bailers and bailer twine, containers, etc., shall be placed on the polyethylene sheet, never on the ground.
- 4.4.4. Don disposable gloves, prepare pump and tubing for insertion into the well, ensuring that any tubing or pump apparatus is of sufficient length to reach the appropriate depth for pumping. Pumping shall occur within the well screened interval as indicated on the well construction diagram. If the well construction information is not available, the bottom of the tubing or pump shall be placed 1' - 2' above the bottom of the well.
- 4.4.5. Lower the pump and/or tubing gently into the water column to the appropriate depth and begin pumping.
- 4.4.6. Measure pH, temperature, specific conductivity, turbidity and other specific parameters in the well from the first water extracted during the purging process.
- 4.4.7. Remove a volume of water equal to 3 to 5 times the standing water from the well measured into an appropriate container. Purging of the well shall occur at a slow rate to minimize agitation of the water recharging the well.



- 4.4.8. If it is not possible to remove three volumes as described above, due to slow recovery of the well, the well shall be emptied and allowed to recover. In slow-yielding wells, whenever full recovery exceeds two hours, the sample shall be extracted as soon as a sufficient volume is available for a sample for each parameter.
- 4.4.9. Measure pH, temperature, specific conductivity, turbidity and other specific parameters prior to sampling.
- 4.4.10. Well evacuation is deemed to be complete when the following criteria have been met:
- pH measurements vary no more than ± 0.5 standard units.
 - specific conductivity measurements vary no more than $\pm 10\%$.
 - temperature measurements vary no more than $\pm 1^\circ\text{C}$.
 - turbidity measurements (if used) are below 5 NTU, if practicable.
- Alternatively well purging shall be deemed complete if a maximum of five well volumes have been removed from the well and/or other site-specific or method-specific parameters have stabilized.
- 4.4.11. Measure pH, temperature, specific conductivity and turbidity (and other specific parameters) again after sampling to determine the effectiveness of purging and sample stability.
- 4.4.12. Do not re-use purging equipment (bailers, rope, tubing, sampling vials, etc.). Any non-disposable bailers shall be returned to the office for decontamination. Pumps shall be decontaminated between monitoring wells, in accordance with procedures noted in Section 4.7.
- 4.4.13. Bailer twine and other consumables, such as filter apparatus, shall be disposed of appropriately.
- 4.4.14. Record sampler's name, sampling time, volume of water purged, parameters measured, weather conditions, sample number, analyses required and all other pertinent information on appropriate field forms, and complete the chain of custody form. The field paperwork shall also provide an indication of other field conditions that could potentially impact water levels (such as a pond being drained, or presence of a beaver dam in nearby surface water).



- 4.4.15. As dictated by project-specific requirements and/or groundwater quality considerations, any water purged from the monitoring wells shall be stored in properly labeled containers for disposal.
- 4.4.16. Storage shall be in properly labeled containers approved for storage of hazardous materials, and in an appropriate designated location at the site.

4.5. Sample Withdrawal

- 4.5.1. In order to ensure that the groundwater sample is representative of the formation, it is important to minimize physical alteration (i.e. agitation during purging and/or sample collection) or chemical contamination of the sample during the withdrawal process. The sample set shall include enough dedicated bailers and sample jars to obtain samples from each well, and additional quality assurance/quality control s (QA/QC) samples such as duplicates, trip blanks and equipment blanks. In addition, it is recommended to increase the supply of sampling equipment and sample jars by about 10% to account for broken or missing ones.
- 4.5.2. Use either an appropriate pump or bailer to purge each well (the same pump used for purging may be used for sample withdrawal, with the exception that samples intended for VOC analysis must be collected using either a bailer or a bladder pump.). Do not reuse a bailer in the field; used bailers shall be returned to the office for decontamination.
- 4.5.3. To minimize agitation of the water column, samples shall be collected from the pump tubing in the following order into pre-labeled sample containers:
- Extractable organics (semi-volatile)
 - Total petroleum hydrocarbons
 - PCBs
 - Metals
 - Phenols
 - Cyanide
 - Chloride and sulfate



- Nitrate and ammonia
- Turbidity
- Radionuclides

Samples to be analyzed for the following constituents shall be collected using a bailer, after any pump and tubing have been removed from the well. Removal of any downhole equipment shall be done carefully and in a manner that minimizes disturbance of the water column.

- Volatile organic compounds (VOCs)
- Purgeable organic carbon (POCs)
- Purgeable organic halogens (POX)
- Total organic halogens (TOX)
- Total organic carbon (TOC)

4.5.4. Samples shall be obtained from the monitoring wells as soon as possible after purging. This may require waiting an extended period for low-yielding wells.

4.5.5. Samples collected for VOC analysis shall be free of any air bubbles and inverted upon filling. Bacterial samples shall be collected using dedicated gloves; taking care not to allow anything to touch the inside of the sampling container.

4.5.6. Samples collected for dissolved metals analysis, which are to be filtered in the field, shall be passed through a 0.45 micron (maximum) filter (either in-line or under negative pressure) prior to placement in the sample bottle.

4.5.7. In situations where replicate samples shall be required, care shall be taken to ensure that each sample collected is independent.

4.5.8. In some situations, inorganic parameters may be sampled directly from a pump after completion of well evacuation procedures.

4.6. Field Documentation

4.6.1. Field documentation shall include at a minimum: a chain-of-custody form, Field Data Record Groundwater Form, Sample Collection Form,



Daily Field Report, Field Quality Review Checklist. Sample labels shall be used for proper sample identification.

4.6.1.1. The labels shall be sufficiently durable to withstand immersion for 48 hours without detaching and to withstand normal handling. The information provided shall be legible at all times.

4.6.1.2. The following information shall be provided on the sample label using an indelible-ink pen:

- Sample identification number.
- LEA Commission Number.
- Date and time of collection.
- Place of collection.
- Parameter(s) requested (if space permits).

4.6.1.3. A field logbook and/or appropriate field forms will be used to log all pertinent information with an indelible-ink pen. The following information shall be provided:

- Project and site identification.
- LEA commission number.
- Identification of well.
- Static water level measurement technique.
- Presence of immiscible layers and detection method.
- Time well purged.
- Collection method for immiscible layers and sample identification numbers.
- Well evacuation procedure/equipment.
- Sample withdrawal procedure/equipment.
- Date and time of collection.
- Types of sample containers used and sample identification numbers.
- Preservative(s) used.



- Parameters requested for analysis.
- Field analysis method(s).
- Whether or not field filtration was performed and the filter size, if appropriate
- Field observations on day of sampling event.
- Record of site activities.
- Field personnel.
- Climatic conditions, including air temperature.
- Status of total production.
- Record of non-productive time

4.6.1.4. The chain-of-custody record shall include the following information:

- Company's name and location.
- Date and time of collection.
- Sample number.
- Container type, number, size.
- Preservative used.
- Signature of collector.
- Signatures of persons involved in the chain of possession.
- Analyses to be performed.
- Type and number of samples.

A separate entry shall be made for each sample, and within each sample each case that a different preservative is used.

4.6.1.5. The Field Data Record Groundwater Form shall be updated during the sampling of each well and include the following information:

- Identification of well.
- Well depth, diameter, depth to water.
- Static water level depth and measurement



technique.

- Purge volume and pumping rate.
- Time well purged.
- LEA commission number.
- Date.

4.7. Equipment Decontamination

All materials and equipment, which enter a well, must be clean and free of any potential contaminants. In general, the equipment and materials entering the well shall be unused and preferably disposable. Any items not considered disposable shall be decontaminated prior to commencing field activities. If field decontamination is required, the choice of decontamination procedures shall be based upon a knowledge of the site-specific contaminants and as outlined in the site-specific work plan.

For sites at which the contaminants are unknown, but contamination is suspected, the decontamination procedures outlined below shall be followed.

- 4.7.1. Prior to commencing any field activities, the following solutions (as appropriate for the appropriate contaminants) shall be prepared and placed into 500-ml laboratory squirt bottles: 10% methanol in water; 10% nitric acid in water; 100% n-hexane; distilled, de-ionized water.
- 4.7.2. In the field, prepare approximately 2.5 gallons of a solution of Alconox® (or other suitable non-phosphate laboratory grade detergent) in tap water in a 5-gallon bucket.
- 4.7.3. Prepare a piece of 5-mil polyethylene sheeting to underlie the decontamination area. The sheeting shall be of sufficient size to contain any accidental discharge of decontamination solutions. The plastic shall be bermed to contain spills.
- 4.7.4. The order for decontaminating equipment is as follows:
 - 1) Detergent scrub
 - 2) DI water rinse
 - 3) Hexane rinse (to be used only if separate-phase petroleum product, other than gasoline, is present)
 - 4) DI water rinse



- 5) 10% nitric acid rinse (to be used only when metals are suspected as potential contaminants)
- 6) DI water rinse
- 7) Methanol rinse (<10% solution)
- 8) Air dry

4.7.5. Materials considered disposable such as the bailer cord, pump tubing, filters, etc. shall not be decontaminated and shall be disposed of in accordance with all applicable municipal, state, and federal regulations.

4.7.6. Wrap each piece of decontaminated equipment in aluminum foil, as appropriate, to maintain cleanliness.

4.7.7. At the end of the project day, dispose of all spent decontamination fluids and materials such as the polyethylene sheeting and personal protective equipment in accordance with all applicable municipal, state, and federal regulations.

5. Quality Assurance/Quality Control

Typically samples taken for Quality Assurance/Quality Control for liquid sample collection include duplicate samples, equipment blanks and trip blanks. The necessity for these samples will be outlined in the site-specific work plan. In general, all QA/QC measures taken during liquid sample collection shall be in conformance with LEA's SOP 10005. Standard QA/QC measure shall include the recording of pertinent information as follows:

5.1. The Field Instrument & Quality Assurance Record, which is a portion of the Daily Field Report, shall include the following information:

- Instrument make, model, and type.
- Calibration readings.
- Calibration/filtration lot numbers.
- Field personnel and signature.

5.2. The Field Quality Review Checklist, which is a portion of the Daily Field Report, shall assure the completeness of the sampling round and include the following information:

- Reviewer's name and date.



- Review of all necessary site activities and field forms.
- Statement of corrective actions for deficiencies.

6. References

- 6.1. EPA, *RCRA Groundwater Monitoring Technical Enforcement Guidance Document*, OSWER 9950.1, September 1986.
- 6.2. EPA, *Practical Guide for Groundwater Sampling*, EPA/600/2-85/104, September 1985.
- 6.3. DEP, Site Characterization Guidance Document, Draft, June 12, 2000.

END OF DOCUMENT



Loureiro Engineering Associates, Inc.
Standard Operating Procedure
for
Quality Assurance/Quality Control Measures
for
Field Activities

SOP ID: 10005

Date Initiated: 02/20/90

Revision No. 004: 12/31/01

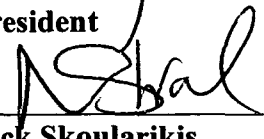
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President



12/19/01
Date



Nick Skoularikis
Director of Quality



12/19/01
Date

REVISION RECORD

<u>Rev #</u>	<u>Date</u>	<u>Additions/Deletions/Modifications</u>
Initial Issue	02/20/90	
001-003	-	No Record
004	12/31/01	Updated to reflect new SOP format. Added section 4.3, Results Evaluation Minor revisions throughout



Loureiro Engineering Associates, Inc.
Standard Operating Procedure
for
Quality Assurance/Quality Control Measures
for
Field Activities

1. Statement of Purpose

This document describes procedures to be followed for proper Quality Assurance Quality Control (QA/QC) practices which shall incorporate all activities associated with sampling tool and instrument preparation, field measurements and sampling, proper documentation of field and post-field activities, QC sample preparation, chain-of-custody protocol and laboratory analytical procedures. The use of specific QA/QC measures is project-specific as defined in the project work plan. This standard operating procedure (SOP) was adopted in accordance with the Environmental Protection Agency (EPA) document *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846).

2. Definitions

- 2.1. Trip Blank: An aliquot of organic-free water or equivalent neutral reference material carried into the field but not exposed.
- 2.2. Equipment Blank: An aliquot of analyte-free deionized water processed through all sample collection equipment.
- 2.3. Replicate Samples: Samples that have been divided into two or more portions in the field.
- 2.4. Collocated Samples: Independent samples collected under identical circumstances in a way that they are equally representative of the parameter of interest.
- 2.5. Performance Evaluation (PE) Sample: A sample that mimics actual samples in all possible aspects, except that its composition is known to the auditor and unknown to the analyst.

3. Equipment

None



4. Procedure

4.1. General

4.1.1. All QA/QC sample preparation procedures shall be properly documented including:

- Name of person(s) or laboratory involved in sample preparation.
- Reagents used.
- Sample number.
- Analyses required.
- Concentration calculations.
- Accuracy of measurements.
- Number, type, size of containers used.
- Preservation method.
- Date and time of sample preparation.

4.1.2. All information shall be included in the field logbook and/or appropriate field forms, but not necessarily in the chain-of-custody record except as needed for proper sample identification and analysis. Blind sample numbers are being used in order not to disclose the nature of the sample to the laboratory. No information that would identify the sample as a QA/QC sample shall be included in the chain-of-custody record.

4.1.3. At the conclusion of each sampling day, a quality control review shall be conducted using the Field Quality Review Checklist and the Daily Field Report.

4.2. QC Sample Preparation

4.2.1. Trip Blank

4.2.1.1. Contaminated trip blanks may indicate contamination of the samples during the field trip or shipment to the lab, cross-contamination between the samples, contaminated sample vials, or improper handling.

4.2.1.2. Trip blanks shall be used only with samples that are to be analyzed for volatile organic compounds.



- 4.2.1.3. One trip blank shall be included per shipping container (cooler) carrying sample soil and/or groundwater samples that are to be analyzed for volatile organic compounds
- 4.2.1.4. Trip blanks are prepared using analyte-free deionized organic-free water prior to field activities associated with the sampling event, usually by the laboratory providing the sampling containers. Each trip blank is placed in a 40-ml glass VOA vial and is carried in the same shipping container as the sample(s). Trip blanks should not be opened at any time during transport.

4.2.2. Equipment Blank

- 4.2.2.1. The purpose of an equipment/rinsate blank is to determine if decontamination procedures were adequate or if any of the equipment might contribute contaminants to the sample.
- 4.2.2.2. An equipment blank is prepared by running analyte-free deionized water through all sample collection equipment (bailers, pumps, filters, split-spoon) and placing it in the appropriate sample containers for analysis. If equipment has been decontaminated in the field, the equipment blank shall be collected after decontamination procedures have been performed.
- 4.2.2.3. Equipment blanks shall be used when sampling surface water, groundwater, soil, and sediment.
- 4.2.2.4. One equipment blank shall be collected for each sample bottle/preservation technique/analysis procedure per matrix per sampling event, or as otherwise specified in project-specific documents.

4.2.3. Replicate Samples

- 4.2.3.1. Replicate samples provide precision information on handling, shipping, storage, preparation and laboratory analysis.
- 4.2.3.2. Replicate samples are samples that have been divided into two or more portions in the field. An example of a replicate sample is two identical sample bottles filled with water from the same bailer retrieval. To ensure homogeneity, the bailer should be emptied into a clean, decontaminated beaker used exclusively



for the purpose and containing sufficient volume for both sample containers, and from that into the sample containers.

4.2.3.3. Replicate samples cannot be used when sampling for volatile organic compounds.

4.2.3.4. One replicate sample shall be obtained for each sample bottle/preservation technique/analysis procedure per sampling event or one out of every 20 samples, unless collocated samples are used (see below), or as otherwise specified in project-specific documents.

4.2.4. Collocated Samples

4.2.4.1. Collocated samples provide precision information on sample acquisition, homogeneity, handling, shipping, storage, preparation and laboratory analysis.

4.2.4.2. Collocated samples are independent samples collected in such a way so that presumably they are equally representative of the parameter of interest. Examples of collocated samples are groundwater samples collected sequentially, soil core samples collected side-by-side, or air samples collected essentially at the same time from the same manifold.

4.2.4.3. Collocated samples are especially useful when sampling for volatile organic compounds, for which replicate samples cannot be used.

4.2.4.4. Collocated samples shall be obtained for each sample bottle/preservation technique/analysis procedure per sampling event or one out of every 20 samples, unless replicate samples are used (see above), or as otherwise specified in project-specific documents.

4.2.5. Split Samples

4.2.5.1. The purpose of split samples is to provide an assessment of the laboratory analytical procedure.

4.2.5.2. Split samples are collocated or replicate samples sent to two (or more) different laboratories.



4.2.5.3. Split samples can be used with any sample media. Split samples can be used in conjunction with spiked samples (see below). In case contradictory results are obtained from the samples split between different laboratories, the spiked samples can be used to verify the analytical data (provided that the spiked samples were properly prepared and the appropriate documentation is available).

4.2.5.4. When used, one split/spiked sample per sample bottle/preservation technique/analysis procedure per sampling event or every 20 samples shall be included, or as specified in project-specific documents.

4.2.6. Spiked Samples

4.2.6.1. The purpose of spiked samples is to provide information on the precision of the laboratory analytical procedure. However, besides a wrong preparation, several other sources of error exist such as analyte stability, holding time and interactions with the sample matrix.

4.2.6.2. Spiked samples are samples spiked with the contaminants of interest. The compounds used for spiking should be of the same chemical group as the contaminants being investigated, but they do not have to be the exact chemical compounds. Spiking should be carefully designed and performed prior to the field investigations. Field matrix spikes are not generally recommended because of the high level of technical expertise required for proper preparation and documentation.

4.2.6.3. Can be used with any sample media, however, liquid matrices are preferred due to uniformity of mixing.

4.2.6.4. When used, one split/spiked sample per sample bottle/preservation technique/analysis procedure per sampling event or every 20 samples shall be included, or as otherwise specified in project-specific documents. In order to ensure defensible data, performance evaluation (PE) samples, prepared by an independent vendor, are typically being used. The ordering and handling procedures and record keeping requirements are discussed in LEA's *SOP for Preparation of PE Samples* (SOP 10030).



4.3. Result Evaluation

4.3.1. The analytical results on QA/QC samples should be evaluated along with the remaining analytical data as follows:

4.3.1.1. No constituents should be detected in the trip blank or equipment blank.

4.3.1.2. The relative percent differences (RPDs) shall be computed for all constituents detected in both duplicate samples used.

The RPD between two measurements (e.g., M1 and M2) is calculated as follows:

$$RPD = \frac{|M1 - M2|}{(M1 + M2)/2} \times 100\%$$

4.3.1.3. Any deviations in the performance evaluation samples shall be brought to the attention of the laboratory. An investigation shall then be performed by the laboratory of the method used, laboratory QA/QC procedures followed, and computations performed. The laboratory shall report the results of their investigation and any corrective actions taken.

5. References

5.1. EPA, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846).



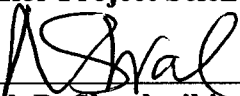
Loureiro Engineering Associates, Inc.
Standard Operating Procedure
for
Soil Sampling

SOP ID: 10006
Date Initiated: 02/20/90
Revision No. 008: 12/31/01

Approved By: _____


Kimberly Clarke
Senior Project Scientist

12/19/01
Date


Nick D. Skoularikis
Director Of Quality

12/19/01
Date

REVISION RECORD

<u>Rev #</u>	<u>Date</u>	<u>Additions/Deletions/Modifications</u>
Initial Issue	02/20/90	.
001-004	-	No record.
005	07/19/00	Revisions to template, including new logo.
006	05/16/01	Revisions to Sections 4.2.1, 4.2.2; add Section 4.2.3.
007	07/27/01	Updated to conform with new SOP format.
008	12/31/01	Minor revisions throughout.



Loureiro Engineering Associates, Inc.
Standard Operating Procedure
for
Soil Sampling

1. Purpose and Scope

This document discusses procedures for collection of soil samples for analysis. Methods for collection and quality assurance/quality control (QA/QC) requirements are covered under separate standard operating procedures (SOPs). The procedures outlined in this document are in accordance with ASTM Standard D 420 and the Environmental Protection Agency (EPA) document entitled, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846). These procedures may vary slightly according to project-specific requirements.

2. Definitions

2.1. Field Forms: For the purpose of document and data control, a form is a document used in the conduct of company business to collect data, including approvals where required. Completed forms providing objective evidence of quality related activities are retained as quality records.

3. Equipment

3.1. Equipment required for the collection of soil samples shall include:

- Stainless steel spatula or dedicated wood spatula.
- Decontamination solutions, including distilled water, 10 percent methanol, 10 percent nitric acid.
- Hand towels.
- Polyethylene plastic sheeting.
- Sample collection jars.
- Clean disposable gloves.
- Field documentation.
- Indelible ink marker.
- Cooler, cold packs.
- Chain of custody seals and sample labels.
- Balance for weighing samples (for LEA laboratory samples, if needed).
- Utility knife.



- Re-sealable plastic bags.

4. Procedures

4.1. Preliminary Sampling Procedures

4.1.1. Sample Bottles

4.1.1.1. A laboratory request form shall be completed and submitted to the laboratory with following information:

- Project name.
- LEA commission number.
- Date of submittal and date needed.
- Quantity of sample locations and sample points at each location.
- Type(s) of samples.
- Analytes, detection limits and QA/QC needed.
- Cooler(s) required.
- Number of chain of custody forms requested.

4.1.1.2. Check bottles against laboratory request form for completeness. The bottles should also be checked for damage and cleanliness. Confirm with laboratory personnel the adequacy of the preservatives used.

4.1.1.3. The total number of sample sets shall be increased by 10 percent to allow for possible breakage during transport to sites or other contingencies. At a minimum one additional sample bottle set shall be obtained per event.

4.1.1.4. Obtain preprinted labels and paperwork through the LEA information management system.

4.1.1.5. Label/date bottles in the field prior to sample collection. Check for accuracy.

4.1.1.6. A cooler with adequate ice or cold packs should be obtained from the laboratory to insure that the collected samples remain at 4 degrees Celsius during transport. Packing material should also be obtained to insure against breakage during transport.



4.1.2. Site Preparation

- 4.1.2.1. A level table shall be placed within the exclusion zone and covered with polyethylene sheeting.
- 4.1.2.2. Decontaminated spatulas shall be placed on the table. Sample bottles shall be placed in a convenient location and in order of sample collection.
- 4.1.2.3. PID and plastic bags shall be placed on the table for VOC screening, if necessary.

4.2. Cleaning and Decontamination

- 4.2.1. Prior to collecting a soil sample, the LEA representative will ensure that all necessary sampling equipment is clean and decontaminated according to the procedure outlined in section 4.2.3 or according to the site specific work plan if different than below.
- 4.2.2. Upon completion of all sampling requirements and prior to leaving the site, all equipment used for sampling shall be cleaned and decontaminated according to the procedure outlined in section 4.2.3 or according to the site specific work plan if different than below. All generated decontamination fluids shall be containerized and disposed of in accordance with the site-specific work plan and all municipal, state, and federal requirements.
- 4.2.3. The decontamination procedure of durable sampling equipment will be accomplished via swabbing the surfaces with a solvent. The order of decontamination is as follows:
 - Detergent swab.
 - DI water rinse.
 - Hexane rinse (to be used if separate-phase petroleum product, other than gasoline is present).
 - DI water rinse.
 - 10 percent nitric acid rinse (to be used only when metals are suspected as potential contaminants).
 - DI water rinse.
 - Methanol rinse (less than 10 percent solution).
 - Air dry.



4.3. Sampling Procedures

- 4.3.1. All personal protective equipment (PPE) should be donned and maintained in accordance with the site-specific work plan or health and safety plan during all sampling procedures. In the event that no PPE has been specified for a particular sampling event, disposable latex gloves should be donned, as a minimum, during all sampling procedures.
- 4.3.2. The particular soil sampling device (i.e., hand auger, split spoon, etc.) shall be retrieved from the point of collection and placed on a level table covered in polyethylene sheeting.
- 4.3.3. Using a decontaminated stainless steel spatula or dedicated wood spatula, the soil shall be transferred directly into soil sampling containers. Care should be taken to completely fill the sample container intended for VOC analysis. Large void spaces within the container shall be minimized by packing, not agitation.
- 4.3.4. Wipe the rim of the sample container with a clean paper towel to remove excess solids, which would prevent adequate sealing of the sample container and seal the container.

The order of sample collection shall be as follows:

- Samples to be analyzed for volatile organic compounds (VOCs) at the LEA Analytical Laboratory.
 - Samples to be analyzed for VOCs using appropriate EPA methodologies.
 - Samples to be screened for total VOCs with a total volatile organic analyzer.
 - Samples to be analyzed for other organic and inorganic constituents.
- 4.3.5. As required, affix a custody seal, noting the date and time of collection across the cap/bottle interface and on the sample label. Place and secure sample within cooler and complete all sample collection documentation. Alternatively, a custody seal shall be used to seal the entire cooler rather than individual sample containers.



4.4. Post Sampling Procedures

- 4.4.1. As required, upon completion of all sampling procedures for a particular site, secure the lid of the cooler using packaging tape with the chain of custody inside.
- 4.4.2. If the laboratory is local, transport the samples directly to the laboratory and present them to the sample manager. The representative of LEA should witness the verification of the chain of custody and obtain a carbon copy for filing in the project notebook.
- 4.4.3. If the laboratory is distant, arrange for transport with a reputable carrier service. Typically, the laboratory specifies the carrier to be used and provides the shipping papers. The cooler and samples shall be secured for transport, and all mailing documentation secured onto the top of the cooler. Unless otherwise specified, delivery shall be overnight. Friday shipments should be mailed for Saturday delivery, once confirmed that the laboratory can accept them on Saturday. The laboratory shall provide confirmation of acceptance noting the temperature of the temperature blank and any deviations from the chain of custody.

4.5. Documentation

- 4.5.1. The following general information shall be recorded in the field log book and/or on the appropriate field forms:
 - Project and site identification.
 - LEA commission number.
 - Field personnel.
 - Name of recorder.
 - Identification of borings.
 - Collection method.
 - Date and time of collection.
 - Types of sample containers used, sample identification numbers and QA/QC sample identification.
 - Preservative(s) used.
 - Parameters requested for analysis.
 - Field analysis method(s).
 - Field observations on sampling event.
 - Name of collector.
 - Climatic conditions, including air temperature.



- Internal temperature of field and shipping (cooled) containers.
- Chronological events of the day.
- Status of total production.
- Record of non productive time.
- QA/QC data.

4.5.2. The following information shall be recorded on the Daily Field Report QA Checklist:

- Reviewer's name, date, and LEA commission number.
- Review of all necessary site activities and field forms.
- Statement of corrective actions for deficiencies.

4.5.3. The following information shall be recorded on the chain of custody record:

- Client's name and location.
- Date and time of sample collection.
- Sample number.
- Container type, number, size.
- Preservative used.
- Signature of collector.
- Signatures of persons involved in the chain of possession.
- Analyses to be performed.
- Type and number of samples.

4.5.4. The following information shall be provided on the sample label using an indelible ink pen:

- Sample identification number.
- Date and time of collection.
- Place of collection.
- Parameter(s) requested (if space permits).

4.5.5. The following information shall be recorded on the sample collection data sheet:

- Client name, location and LEA commission number.
- Boring or sampling location identification number.
- Date and time of collection.
- Sample number.
- Depth sample was obtained.



- Field instrumentation reading.

5. Quality Assurance/Quality Control

- 5.1. One trip blank sample should accompany the sampling set for each field crew and each field day for which VOC samples are collected.
- 5.2. One equipment blank sample should be collected for each field crew and each field day. Equipment blank samples should be analyzed for the same suite of analytes as the soil samples.
- 5.3. For QA/QC purposes, one duplicate sample will be collected for every twenty samples. The duplicate sample set will be analyzed for the same suite of analytes as the soil samples.

6. References

- 6.1. ASTM Standard D 420
- 6.2. EPA, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846).

END OF DOCUMENT



Loureiro Engineering Associates, Inc.
Standard Operating Procedure
For
Low Flow (Low Stress)
Liquid Sample Collection and Field Analysis

SOP ID: 10039

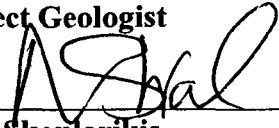
Date Initiated: 06/11/01

Revision No. 001: 04/01/02

Approved By: 

David Brisson
Project Geologist

4/11/02
Date


Nick Skoularikis
Director of Quality

4/11/02
Date

REVISION RECORD

<u>Rev #</u>	<u>Date</u>	<u>Additions/Deletions/Modifications</u>
Initial Issue	06/11/01	
001	04/01/02	Updated to reflect new SOP format.



Loureiro Engineering Associates, Inc.
Standard Operating Procedure
For
Low Flow (Low Stress)
Liquid Sample Collection and Field Analysis

1. Purpose and Scope

This standard operating procedure (SOP) describes procedures to be followed for measurement of static water level elevations, detection of immiscible layers, well evacuation, sample withdrawal, and field analyses utilizing low flow sampling techniques.

2. Definitions

2.1. Immiscible layers: The term is used to denote free-phase liquids that may be present in the aquifer as a result of a release. These liquids may have a density lighter than water (light non-aqueous phase liquids (LNAPL) or floaters) or heavier than water (dense non-aqueous phase liquids (DNAPL) or sinkers).

3. Equipment

3.1. Equipment required for the collection and field analysis of liquid samples shall include:

- Water-level indicator (accurate to 0.01 foot).
- Distilled water.
- Hand towels.
- Portable volatile organic compound (VOC) analyzer (Photovac Microtip®, Foxboro OVA® or equivalent).
- Interface probe/ clear view bailer.
- Flow-through-cell capable of monitoring pH, temperature, specific-conductance, Eh, dissolved oxygen, and turbidity.
- polyethylene plastic sheeting.
- adjustable rate submersible pump(preferred), adjustable rate centrifugal



pump or bladder pump (constructed of stainless steel or Teflon®), adjustable rate peristaltic pump and polyethylene tubing (1/4 to 3/8 inch I.D.), or other appropriate pumping apparatus.

- Clean disposable gloves.
- Alconox®, or other non-phosphate laboratory grade detergent.
- Three 5-gallon buckets.
- Decontamination brushes.
- Distilled, de-ionized (DI) water.
- Decontamination fluids (< 10% methanol in water, 100% n-hexane, and 10% nitric acid).

4. Procedure

4.1. Equipment Decontamination

All materials and equipment which enter a well must be clean and free of any potential contaminants. In general, the choice of decontamination procedures should be based upon knowledge of the site-specific contaminants and outlined in the site-specific work plan.

For sites at which the contaminants are unknown, but contamination is suspected, the decontamination procedures outlined below should be followed.

- 4.1.1. Prior to commencing any field activities, the following solutions (as appropriate for the appropriate contaminants) should be prepared and placed into 500-ml laboratory squirt bottles: 10% methanol in water; 10% nitric acid in water; 100% n-hexane; distilled, de-ionized water.
- 4.1.2. In the field, prepare approximately 2.5 gallons of a solution of Alconox® (or other suitable non-phosphate laboratory grade detergent) in tap water in a 5-gallon bucket.
- 4.1.3. Prepare a piece of 5-mil polyethylene sheeting to underlie the decontamination area. The sheeting should be of sufficient size to contain any accidental discharge of decontamination solutions. The plastic should be bermed to contain spills.
- 4.1.4. The order for decontaminating equipment is as follows:



- 1) Detergent scrub.
- 2) DI water rinse.
- 3) Hexane rinse (to be used only if separate-phase petroleum product, other than gasoline, is present).
- 4) DI water rinse.
- 5) 10% nitric acid rinse (to be used only when metals are suspected as potential contaminants).
- 6) DI water rinse.
- 7) Methanol rinse (<10% solution).
- 8) Air dry.

- 4.1.5. Materials such as the cord should not be decontaminated and should just be disposed of after each test.
- 4.1.6. Wrap each piece of decontaminated equipment in aluminum foil, as appropriate, to maintain cleanliness.
- 4.1.7. At the end of the project day, dispose of all spent decontamination fluids and materials such as the polyethylene sheeting and personal protective equipment in accordance with all applicable municipal, state, and federal regulations.

4.2. Sample Collection

- 4.2.1. Immediately upon opening the well, the air in the well head will be sampled for VOCs using a portable VOC analyzer, such as a Photovac Microtip® or equivalent. The instrument shall be zeroed with ambient air prior to the measurement, and the initial and final readings shall be recorded for each well.

4.3. Detection of Immiscible Layers

- 4.3.1. Should evidence warrant, a sampling event shall include provisions for detection of immiscible phases prior to well evacuation or sample collection. LNAPLs are relatively insoluble liquid organic compounds with densities less than that of water (1 g/ml), while DNAPLs are organic compounds with densities greater than that of water. Lighter and/or denser immiscible phases may be encountered in a groundwater monitoring well.
- 4.3.2. An interface probe will be used to determine the existence of any immiscible layers, light or dense. Alternatively, a clear fluorocarbon



resin or PVC bailer may be used to determine the existence of the phases or oil sheen in the well when no accurate determination of the immiscible layer thickness is required.

- 4.3.3. Should elevations of the immiscible layers be required, levels of the fluids shall be measured to an accuracy of 0.02 feet using an electronic interface probe capable of detecting the interfaces between air, product, and water. The interface levels shall be recorded in the field form. Adjustments of the observed head to the theoretical hydraulic head shall be calculated based on the density conversion factor associated with the particular non-aqueous phase liquid.
- 4.3.4. If immiscible layers are detected low-flow sampling is not recommended.

4.4. Measurement of Static Water Level

- 4.4.1. The static water elevations in each well shall be measured prior to each sampling event. This is performed initially to characterize the site, and in subsequent sampling rounds to determine whether horizontal or vertical flow gradients have changed. A change in hydrologic conditions may necessitate modification of the groundwater monitoring program.
- 4.4.2. Remove the protective cover and locking cap from the well.
- 4.4.3. Each well shall have a surveyed reference point located at the top of the well casing with the locking cap removed. The reference point shall be easily recognizable, since the personnel conducting the sampling may differ from one sampling event to the next.
- 4.4.4. The following parameters shall be measured with an accuracy of 0.01 ft:
 - Depth to standing water.
 - Depth to bottom of well.
- 4.4.5. A water-level indicator with a fiberglass tape will be used for measurement. Due to possible pressure differences between the well atmosphere and the ambient atmosphere, the water level will be allowed fifteen minutes to equilibrate upon removal of the well cap. If



excess pressure is encountered the water level will be allowed greater than fifteen minutes to equilibrate upon removal of the well cap. The results shall be recorded on the appropriate field form(s).

- 4.4.6. Total depth measurements will be compared to original depths to determine the degree of siltation that may have occurred. This information shall be noted on the field forms. Should significant siltation occur in any well, the well shall be redeveloped by an approved method.
- 4.4.7. The portion of the tape immersed in the well shall be decontaminated during retrieval using a distilled water rinse followed by drying with a clean wipe, prior to use in another well. This decontamination procedure shall be amended, as needed, to accommodate the specific type of contamination anticipated.
- 4.4.8. The static water level should be monitored and recorded throughout the purging and sampling of each well.

4.5. Field Analysis

- 4.5.1. Parameters that are physically or chemically unstable shall be tested utilizing a flow-through-cell. Such parameters as pH, temperature, specific conductance, dissolved oxygen (DO), Oxidation reduction potential (Eh), and turbidity will be measured in the field, at the temperature of the well sample.
- 4.5.2. Parameters such as pH, temperature, specific conductance, DO, Eh, and turbidity shall be measured using a flow-through-cell (YSI model 6820 or equivalent). The meter shall be calibrated prior to use and at the end of the day using supplied solutions, in accordance with the instructions provided by the manufacturer. Calibration information will be recorded in the field before and after each calibration.

4.6. Well Evacuation

- 4.6.1. Calculate standing water in the well based on the following schedule and record on the appropriate field form:



Well Diameter (inches)	Conversion Factor (gal/feet)
2	0.163
4	0.654
6	1.47

- 4.6.2. Generally, a submersible, air-lift, bladder, inertial, or peristaltic pump equipped with a fluorocarbon resin or PVC foot valve on the end of dedicated tubing, as appropriate, may be used to evacuate the monitoring wells.
- 4.6.3. A new piece of polyethylene plastic shall be placed on the ground adjacent to the well. Sampling and purging equipment, such as pump, tubing, containers, etc., shall be placed on the polyethylene sheet, never on the ground.
- 4.6.4. Don disposable gloves, prepare pump and tubing for insertion into the well, ensuring that any tubing or pump apparatus is of sufficient length to reach the appropriate depth for pumping.
- 4.6.5. Lower the pump and/or tubing gently into the water column to the midpoint of the zone to be sampled. A site specific sampling plan should specify the sampling depth, or provide specific criteria for the selection of intake depth for each well. If possible keep the pump intake two feet above the bottom of the well. Start the pump at the lowest speed setting and slowly increase the speed until discharge occurs. Check the water level. Adjust the pump rate until little or no draw down occurs. Draw down should not exceed 0.3 feet, if the draw down exceeds 0.3 feet shut the pump down and allow to recharge. Alternate pumping and recharging until parameters stabilize.
- 4.6.6. Monitor and record water level and pumping rate every three to five minutes during purging. During purging monitor indicator field parameters (turbidity, pH, Eh, DO, temperature and specific conductance) in the well from the first water extracted during the purging process and three consecutive samples taken every three to five minutes. Stabilization is considered to be achieved when three consecutive readings are within the following limits

Turbidity (10% for values less than 5 and greater than 1 NTU).

DO (10%).



Specific Conductance and Temperature (3%).

pH (+/- 0.1 unit).

ORP/Eh (+/- millivolts).

- 4.6.7. If it is not possible to obtain stabilization as described above, due to slow recovery of the well, the well shall be emptied and allowed to recover. Samples obtained from slow-yielding wells shall be extracted as soon as a sufficient volume is available for a sample for each parameter.
- 4.6.8. Measure indicator parameters again after sampling to determine effectiveness of purging and sample stability.
- 4.6.9. Do not re-use purging equipment (bailers, rope, tubing, sampling vials, etc.). Pumps shall be decontaminated between monitoring wells, in accordance with procedures noted in Section 4.1.
- 4.6.10. Record sampler's name, sampling time, volume of water purged, parameters measured, weather conditions, sample number, analyses required and all other pertinent information in the field notebook and/or appropriate field forms, and complete the chain of custody form.
- 4.6.11. Any water purged from the monitoring wells shall be stored in appropriate containers until the laboratory analyses are available. Then it should be disposed of in accordance with all applicable local, state and federal requirements.
- 4.6.12. Storage shall be in containers approved for storage of hazardous materials, and in an appropriate designated location at the facility.
- 4.7. Sample Withdrawal
 - 4.7.1. In order to ensure that the groundwater sample is representative of the formation, it is important to minimize physical alteration (i.e. agitation during purging and/or sample collection) or chemical contamination of the sample during the withdrawal process.
 - 4.7.2. Use an appropriate pump to purge each well (the same pump used for purging may be used for sample withdrawal, with the exception that



samples intended for VOC analysis must be collected using a bladder pump).

4.7.3. To minimize agitation of the water column, samples shall be collected from the pump tubing in the following order into pre-labeled sample containers:

- Extractable organics (semi-volatile).
- Volatile Organic Compounds.
- Total petroleum hydrocarbons.
- PCBs.
- Metals.
- Phenols.
- Cyanide.
- Chloride and sulfate.
- Nitrate and ammonia.
- Turbidity.
- Radionuclides.
- Purgeable organic carbon (POCs).
- Purgeable organic halogens (POX).
- Total organic halogens (TOX).
- Total organic carbon (TOC).

4.7.4. Samples shall be obtained from the monitoring wells as soon as possible after purging. This may require waiting an extended period for low-yielding wells.

4.7.5. Samples collected for VOC analysis shall be free of any air bubbles and inverted upon filling. Bacterial samples shall be collected using dedicated gloves; taking care not to allow anything to touch the inside of the sampling container.

4.7.6. Samples collected for dissolved metals analysis, which are to be filtered in the field, shall be passed through a 0.45 micron (maximum) filter (either in-line or under negative pressure) prior to placement in the sample bottle.



4.7.7. In situations where replicate samples are required, care shall be taken to ensure that each sample collected is independent.

4.7.8. In some situations, inorganic parameters may be sampled directly from a pump after completion of well evacuation procedures.

4.8. Field Documentation

4.8.1. Field documentation shall include at a minimum: a chain-of-custody form, Field Data Record Groundwater Form, Sample Collection Form, Daily Field Report. Sample labels and sample seals shall be used for proper sample identification.

4.8.1.1. The labels shall be sufficiently durable to withstand immersion for 48 hours without detaching and to withstand normal handling. The information provided shall be legible at all times.

4.8.1.2. The following information shall be provided on the sample label using an indelible pen:

- Sample identification number.
- Date and time of collection.
- Place of collection.
- Parameter(s) requested (if space permits).

4.8.1.3. Appropriate field forms will be used to log all pertinent information with an indelible pen. The following information shall be provided:

- Project and site identification.
- LEA commission number.
- Identification of well.
- Static water level measurement technique.
- Presence of immiscible layers and detection method.
- Time well purged.
- Collection method for immiscible layers and sample identification numbers.



- Well evacuation procedure/equipment.
- Sample withdrawal procedure/equipment.
- Date and time of collection.
- Types of sample containers used and sample identification numbers.
- Preservative(s) used.
- Parameters requested for analysis.
- Field analysis method(s).
- Whether or not field filtration was performed and the filter size, if appropriate.
- Field observations on day of sampling event.
- Record of site activities.
- Field personnel.
- Climatic conditions, including air temperature.
- Status of total production.
- Record of non-productive time.

4.8.1.4. The Field Sampling Record shall include at a minimum the following information:

- Identification of well.
- Date and time of collection.
- Name of collector.
- Sample number.

4.8.1.5. The chain-of-custody record shall include the following information:

- Company's name and location.
- Date and time of collection.
- Sample number.
- Container type, number, size.
- Preservative used.



- Signature of collector.
- Signatures of persons involved in the chain of possession.
- Analyses to be performed.
- Type and number of samples.

4.8.1.6. The Field Data Record Groundwater Form shall be updated during the sampling of each well and include the following information:

- Identification of well.
- Well depth, diameter, depth to water.
- Static water level depth and measurement technique.
- Purge volume and pumping rate.
- Time well is purged.
- LEA commission number.
- Date.

4.8.1.7. The Daily Field Record shall include the following information:

- Client's name, location, LEA commission number, date.
- Instrument make, model, and type.
- Calibration readings.
- Calibration/filtration lot numbers.
- Field personnel and signature.

4.8.1.8. The Daily Field Record shall assure the completeness of the sampling round and include the following information:

- Reviewer's name, date, and LEA commission number.
- Review of all necessary site activities and field forms.
- Statement of corrective actions for deficiencies.



5. References

- 5.1. United States Environmental Protection Agency (EPA), Region I. *Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells*, June 30, 1996, Revision 2.
- 5.2. Robert W. Puls and Michael Barcelona, EPA. *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, in Groundwater Issue, (EPA/540/S-95/504), April 1996.
- 5.3. Connecticut Department of Environmental Protection, Bureau of Water Management, Permitting Enforcement and Remediation Division. *Site Characterization Guidance Document*, Draft, June 12, 2000.

END OF DOCUMENT



APPENDIX B

Project Schedule

Voluntary Corrective Action Program
Work Plan
MacDermid Incorporated
526 Huntingdon Avenue

ID	Task Name	Start	Finish	Predecessors
1	VCAP Sampling	Mon 5/13/02	Fri 7/12/02	
2	Project Coordination and Administration	Mon 5/13/02	Fri 7/12/02	
3	Field Activities	Mon 5/13/02	Fri 5/24/02	
4	Collection of Surficial Soil Samples	Mon 5/13/02	Mon 5/13/02	
5	Collection of Groundwater Samples	Tue 5/14/02	Fri 5/17/02	
6	Collection of Sediment Samples	Mon 5/20/02	Wed 5/22/02	
7	Collection of Surface Water Samples	Thu 5/23/02	Fri 5/24/02	
8	Background Research	Mon 5/20/02	Tue 5/21/02	
9	Review of Aerial Photography	Mon 5/20/02	Mon 5/20/02	
10	Review of Sanborn Fire Insurance Maps	Tue 5/21/02	Tue 5/21/02	
11	Evaluation of Institutional Controls	Thu 5/23/02	Fri 5/24/02	
12	Office Administrative Tasks	Mon 5/27/02	Fri 6/14/02	
13	Interpretation of Analytical Data	Mon 6/10/02	Fri 6/14/02	
14	Development of Mapping	Mon 5/27/02	Fri 5/31/02	
15	Development of Environmental Indicator Forms	Mon 6/3/02	Fri 6/14/02	
16	Submit Draft EI to Client	Mon 6/17/02	Mon 6/17/02	
17	Client Review Period	Mon 6/17/02	Fri 6/28/02	
18	EI Revision Period	Mon 7/1/02	Thu 7/11/02	
19	Submittal of EI to USEPA	Fri 7/12/02	Fri 7/12/02	

Project: VCAP Sampling Schedule
Date: Wed 5/1/02

Task

Progress

Summary



External Tasks

Deadline

VCAP Sampling Schedule
Wed 5/1/02

Sampling So
Wed 5/1/02